USARIEM TECHNICAL REPORT T14-3

PREDICTIVE MODELS TO ESTIMATE PROBABILITIES OF INJURIES AND ADVERSE PERFORMANCE OUTCOMES IN U.S. ARMY BASIC COMBAT TRAINING

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Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to Army Regulation 70-25 and USAMRMC Regulation 70-25 on the use of volunteers in research. For protection of human subjects, the investigator(s) adhered to policies of applicable federal law CFR 46.

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EXECUTIVE SUMMARY

Negative training outcomes in U.S. Army basic combat training (BCT) are costly and difficult to prevent and manage. Among outcomes of interest are injuries, attrition, and physical performance deficits. Statistical methods to predict these outcomes with regression equations have been used in many previous reports, but in most instances the primary focus was to identify risk factors and characterize their impact in terms of odds ratios or relative risk ratios. Rarely have such models been used to provide estimates of probabilities for these negative outcomes for individual recruits.

This report provides details from statistical models predicting probabilities of injury, attrition, and failure on the Army Physical Fitness Test (APFT) during BCT. The models were derived from multivariate logistic regression analyses of data from a study conducted at Fort Jackson, SC from 7 June-13 August 2010. Potential predictor variables consisted of information collected from 563 recruits (414 men and 149 women) at or near the beginning of BCT. Data were assembled from demographic databases, baseline physical fitness tests, and a survey of self-reported lifestyle characteristics. Outcomes of interest were injuries incurred during BCT (as defined by 5 separate injury indices), attrition due to any cause, and failure to pass the initial administration of the final APFT conducted near the end of BCT.

Statistical models predicting probability of injury included: gender, initial fitness test scores, race/ethnicity, self-reported physical activity level prior to BCT, injuries sustained prior to BCT, height, and tobacco use. Models predicting probability of APFT failure and attrition included gender, initial fitness test scores, age, and tobacco use as predictors. The models performed with levels of prognostic accuracy (defined by areas under the curves (AUCs) for receiver-operating characteristic [ROC] plots) considered poor to fair for predicting injury (AUCs from 0.67 to 0.73), fair for attrition (AUC = 0.78), and good for APFT failure (AUC = 0.82). The models generated relatively low pseudo- R^2 values, ranging from 0.105 to 0.234.

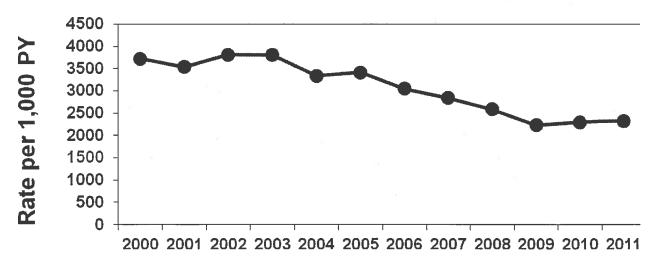
Unique to this report is the presentation of tables with coordinate points for the ROC curves – allowing for characterization of prognostic accuracy at any given cutscore on the probability scale that might be selected to distinguish low-risk from high-risk recruits. The trade-off between sensitivity and specificity is discussed in the report, using illustrative cut-scores from one of the models. These illustrations and the accompanying tables of coordinate points allow for deliberate and informed selection of risk probability cut-scores depending on whether the goal is to minimize numbers of recruits falsely categorized as being at high risk for the outcomes, or alternately, to minimize numbers of recruits falsely categorized as being at low risk for the outcomes.

Results in this report are provided in a format that will allow for direct comparisons with other, more complex predictive models designed to capture nonlinear relationships among injuries, poor physical performance, exercise dose, and individual biomechanical factors. Comparisons of prognostic accuracy from the different types of modeling approaches will permit testing of a hypothesis that better accuracy can result from more complex models.

INTRODUCTION AND BACKGROUND

The high rate of injuries in basic combat training (BCT) has a significant negative impact on military readiness, medical costs, lost duty days, recruit attrition and the number of deployable soldiers. A study of BCT at Ft Jackson, SC reported that 19% of recruits failed to complete training with their peers, 15% failed the Army physical fitness test (APFT), and 29% suffered at least one overuse injury. Over the past 30 years, injury rates (% injured trainees per month) during Army BCT have ranged from 6% to 21% for men and 16% to 33% for women, with median rates of about 13% for men and 28% for women.² Historically, the injury incidence for women tends to be twice that of men during BCT.² These data indicate that musculoskeletal injuries remain endemic among recruits in BCT despite systematic investigation for over 35 years.³ Nonetheless, there has been some progress made in injury prevention. Studies have identified a number of factors increase injury risk among recruits; these include female gender, older age, high and low body mass index (BMI), low initial physical fitness, prior physical inactivity, cigarette smoking, prior injuries, menstrual irregularities, the summer season, and higher levels of ambulatory activity.^{3, 4} Interventions that have been demonstrated to reduce injuries in BCT have included modifications in physical training,⁵ preconditioning of recruits,⁶ moving medical assets closer to recruits,⁷ use of specific sock systems⁸ and antiperspirants⁹ to reduce foot blisters, and use of mouthguards for reducing orofacial injuries. 10 These and other efforts have been associated with reduced BCT injuries over time as shown in Figure 1¹¹ but injury incidence remains relatively high.

Figure 1. US Army Recruit Injury Visit Rate 2000-2011 (Data from the Defense Medical Surveillance System).¹¹ PY = Person-year.



Prediction of risk for individual recruits remains an important goal in the effort to understand and control the problem of negative training outcomes in BCT. The Joint Services Physical Training Injury Prevention Work Group completed a review of evidence for prevention of injuries related to military physical training. A major recommendation called for "detailed statistical modeling techniques ... to develop a multivariate injury risk index, utilizing known risk factors for musculoskeletal injury, for the purpose of identifying those at greatest risk and targeting interventions to reduce that risk." The predictive models presented in this report help address that recommendation.

Traditional statistical methods make use of predictor variables that are available at or near the beginning of training to construct predictive equations for injury or other adverse outcomes. Purely statistical methods are however limited by available predictors: typically demographic, self-report, and some performance test data. It has been hypothesized that augmented computational models that also include exercise dose in military physical training regimens and estimated biomechanical attributes of recruits in ways that capture nonlinear relationships can provide greater prognostic accuracy than models using statistical methods alone. Direct comparisons of prognostic accuracy indices for models derived using the two methods (purely statistical vs. augmented) on the same data from military training may help assess whether prognostic accuracy can be improved as hypothesized using more complex non-linear computational methods. This paper focuses on statistical models using predictor variables that can be compared with augmented models currently under development.

Therefore, the purpose of this study was to examine available BCT data in order to derive predictive models with statistical methods that would provide the best available prognostic accuracy given the set of potential predictor variables in the dataset. Target outcomes for prediction were injury (defined with 5 separate sets of criteria), failure to complete BCT, and failure to pass the final APFT.

METHODS

STUDY DESIGN

This prospective observational study was conducted during a 10-week BCT cycle at Ft Jackson, SC from 7 June-13 August 2010. Six companies were tracked with 200 Soldiers per company divided into four platoons. The specific companies studied were selected by the Brigade commander.

Volunteers completed a questionnaire and were measured for body mass and stature. Army Physical Fitness Test (APFT) scores were collected immediately following each test. Injury data were collected from the Defense Medical Surveillance System (DMSS) two months after the completion of training for all volunteers.

Participant Population

Participants were recruited from the U.S. Army Basic Combat Training Battalion at Ft Jackson, SC (414 men and 149 women). All recruits were briefed and read the consent form. Those who chose to volunteer signed the consent form prior to any data collection.

Questionnaire

After the informed consent briefing, all volunteers were asked to complete the Questionnaire in Appendix A. The questionnaire contained items on height, weight, date of birth, tobacco use, physical activity, injury history and menstrual history. Test administrators were available to answer questions; all responses were checked for completion prior to releasing each volunteer.

Height and Weight

Following completion of the questionnaire, volunteers removed their boots and Army Combat Uniform (ACU) jackets and proceeded to one of several stations to be measured for height and weight. Height (inches) was measured in stocking feet using a stadiometer (Seca, Hamburg, Germany). Body mass (lbs) was measured in stocking feet, ACU pants, undergarments and t-shirts using a digital scale (Seca model 770, Hamburg, Germany).

APFT Data Collection

The 1-1-1 initial physical fitness test (IPFT) consisted of a one-minute maximum push-up test, one-minute maximum sit-up test, and a one-mile run for time. At Ft Jackson, all companies were administered the 1-1-1 IPFT during the first week of BCT. A passing standard is 13 pushups, 17 sit-ups and a one mile run in 8:30 minutes for males and 3 pushups, 17 sit-ups and a one mile run in 10:30 minutes for females. The standard APFT consisted of a two-minute maximum push-up test, two-minute maximum sit-up test, and a two-mile run for time All recruits were required to score 50 points on each of three APFT events to graduate from BCT. Points were age and gender normed. These data were obtained from the units and checked in the Resident Individual Tracking Management System (RITMS), which is a Training and Doctrine Command (TRADOC) database. Missing data were verified or filled in by the company training NCO or obtained from RITMS. If recruits failed the final APFT they were allowed to repeat the entire test again, at the discretion of their drill sergeants, but only the first administration of the final APFT was considered in the present analysis.

Injury Data Collection

Study volunteers authorized access to their electronic medical information compiled in the Defense Medical Surveillance System (DMSS) to screen for injuries during the course of BCT. The Armed Forces Health Surveillance Center (AFHSC) regularly compiles data on ambulatory (outpatient) encounters that occur within military treatment facilities (MTFs), as well as those that occur outside the MTFs but are paid for by the Department of Defense. To obtain DMSS injury data, the name, military personal identifiers, and inclusive dates of BCT for all consenting recruits were sent to the Armed Forces Health Surveillance Center (AFHSC). This was done two months after the completion of the BCT cycle (Nov 2010) to assure that all medical visits had been entered into the DMSS. The AFHSC returned visit dates and International Classification of Diseases, Revision 9, Clinical Modification (ICD-9-CM) codes for outpatient medical visits within the BCT time frame. The first four diagnoses for each visit were considered (although a single visit usually included only one diagnosis). An injury case was defined as a recruit who had a specific ICD-9-CM code that was included in one of five injury indices. These injury indices were the Installation Injury Index (III), the Modified Installation Injury Index (MIII), the Training Related Injury Index (TRII), the Overuse Injury Index (OII), and the Comprehensive Injury Index (CII) as described previously.1

The III has been used to compare injury rates among different military posts and is reported on a monthly basis at the AFHSC website (http://afhsc.Army.mil/), where the specific ICD-9-CM codes are also provided. The MIII is similar to the III but captures a greater number of overuse-type injuries (i.e., those resulting from cumulative microtrauma). The OII specifically captures the subset of both upper and lower body overuse-type musculoskeletal injuries and includes such diagnoses as stress fractures, stress reactions, tendonitis, bursitis, fasciitis, arthralgias, neuropathies, radiculopathies, shin splints, synovitis, and strains. The TRII is limited to lower extremity overuse

injuries and has previously been used to compare injury rates among basic training posts. The CII captures all ICD-9-CM codes related to injuries, both traumatic and overuse. The CII attempts to include all injuries that are classically defined in epidemiology as physical damage to the body as a result of an energy exchange.¹⁴

Recruit attrition was defined as failure to successfully complete a cycle of training either because of recycling or discharge from service. A recruit is recycled when he or she is sent to another company to complete training. Recruits must complete a series of requirements to graduate from BCT (i.e., basic rifle marksmanship, gas mask training, basic first aid). Soldiers may be recycled for failing to master a skill or physical task, or for losing training time due to injury or illness. A discharge occurs when a recruit is terminated from service due to psychological, behavioral, or physical problems.

Data Handling

There were 43 potential predictor variables in the dataset (Table 1) representing demographic and baseline physical performance attributes, and responses to a questionnaire designed to capture data on known risk factors for injury and poor performance.

Table 1. Potential predictor variables available in the dataset.

Continuous-scale variables

- Age (yrs)
- Height (cm)
- Weight (kg)
- Number of days smoking cigarettes over 30 days prior to entering BCT
- Number cigarettes smoked per day over 30 days prior to entering BCT
- Total number of cigarettes smoked over 30 days prior to entering BCT
- Number of months since quitting smoking
- Age (yrs) at time of smoking first cigarette
- Age (yrs) at time of smoking first cigarette (softmax scaled*)
- Number of months since quitting smoking (softmax scaled*)
- Smoking duration in years
- Long-term smoking index (smoking duration adjusted for time since quitting)**
- Average number of times per week (over two months prior to entering BCT) a recruit exercised or played sports for at least 30 minutes at a time
- Average number of times per week (over two months prior to entering BCT) a recruit ran or jogged
- Duration in months a recruit ran or jogged prior to entering BCT
- Average number of times per week (over two months prior to entering BCT) a recruit trained with weights for at least 30 minutes at a time
- Duration in months a recruit trained with weights prior to entering BCT
- Total number of times (over two months prior to entering BCT) a recruit ran or jogged
- Total number of times (over two months prior to entering BCT) a recruit

trained with weights

- Activity overestimation index†
- Age (yrs) at menarche
- Age (yrs) at menarche (softmax scaled*)
- Menstrual history index††
- Number of months since last pregnancy
- Number of menstrual periods over the last 12 months
- Number of push-ups on initial (1-1-1) fitness test
- Number of sit-ups on initial (1-1-1) fitness test
- Minutes to complete 1-mile run on initial (1-1-1) fitness test

Categorical-scale variables

- Gender
- Rank
- Component
- Education Level
- Marital Status
- Race/Ethnicity
- Smoked at least 100 cigarettes in lifetime (yes/no)
- Self-rating of amount of physical activity prior to BCT relative to others of same age and gender (ordinal comparative scale)
- Any prior injury to bone, muscle, tendon, ligaments, and/or cartilage in one or both of your lower limbs, ankles, or feet (yes/no)
- Any prior injury that prevented a recruit from participating in normal physical activities for at least one week (yes/no)
- Following prior injuries, was a recruit able to eventually return to 100% of normal physical activities? (yes/no)
- Prior injury index†††
- During 12 months prior to entering BCT, had a female recruit ever missed six or more months in a row between menstrual cycles? (yes/no)
- During 12 months prior to entering BCT, had a female recruit taken birth control pills or any other hormonal therapy? (yes/no)
- Pass/Fail status on initial (1-1-1) fitness test

*Softmax scaling accounted for time-based traits where the logical value for subjects who never had that trait was infinity. To deal with infinite values, original values were rescaled to numbers between 0 and 1 using the logistic function

$$f(x) = \frac{1}{1 + e^{-z/2}}$$
, where $z = \frac{x - \overline{x}}{s_x}$, $\overline{x} = \text{sample mean of the variable } x$, and

 $s_x = \text{sample standard deviation of the variable } x$. The rescaled distribution mapped infinity to 1; original values that were within $2s_x$ from \overline{x} were mapped almost linearly to a symmetric interval around ½.

** Long-term smoking index was computed by the equation: $long Term Smoking = (1-month squit SM) \times smoking Duration., \text{ where } \\ month squit SM = \text{Number of months since quitting smoking (softmax scaled) and}$

$$smokingDuration = \begin{cases} 0 & \text{if} & agesmokeSM = 1\\ age-agesmoke-monthsquit/12 & \text{if} & agesmokeSM < 1 & \text{and} & age-agesmoke \\ 0.5 & \text{if} & age = agesmoke \\ 0.5 & \text{if} & age = agesmoke + 1 & \text{and} & 12 \le month \\ age-agesmoke-monthsquit/12 & \text{if} & age = agesmoke + 1 & \text{and} & monthsquit \end{cases}$$

† Activity overestimation index was computed by the equation: activityOverestimationIndex = paprebctSM - paweekNumSM., where paprebctSM = and sofmax rescaling of Self-rating of amount of physical activity prior to BCT relative to others of same age and gender (ordinal comparative scale), and paweekNumSM = softmax rescaling of Average number of times per week (over two months prior to entering BCT) a recruit exercised or played sports for at least 30 minutes at a time.

†† Menstrual history index was computed by the equation:

```
\begin{split} \textit{MenstrualHistoryIndex} &= nomenst12 + 1 + \frac{4.5I(birthconrol = Yes)}{(1 + agemenstSM)}, \text{ where } nomenst12 \\ &= \text{Number of menstrual periods over the last } 12 \text{ months, } I(birthcontrol = "Yes"}) = \\ & \left\{ \begin{array}{c} 1 \text{ } if \text{ } birthcontrol = "Yes"} \\ 0 \text{ } otherwise \end{array} \right\}, \text{ and } agemenstSM = \text{softmax rescaling of Age at menarche.} \end{split}
```

††† Prior injury index was computed by the equation:

$$priorInjuryIndex = \begin{cases} 0 & \text{if} \quad everinjured = 2\\ 1 & \text{if} \quad everinjured = 1, preventpa = 2, return100 = 1\\ 2 & \text{if} \quad everinjured = 1, preventpa = 1, return100 = 1\\ 3 & \text{if} \quad everinjured = 1, preventpa = 2, return100 = 2\\ 4 & \text{if} \quad everinjured = 1, preventpa = 1, return100 = 2. \end{cases}$$

, where *everinjured* = Any prior injury to bone, muscle, tendon, ligaments, and/or cartilage in one or both of your lower limbs, ankles, or feet (1=yes; 2=no), *preventpa* = Any prior injury that prevented a recruit from participating in normal physical activities for at least one week (1=yes; 2=no), and *return100* = Following prior injuries, was a recruit able to eventually return to 100% of normal physical activities? (1=yes; 2=no).

DATA ANALYSIS

Descriptive statistics were computed to characterize demographic and performance attributes of recruits and to quantify incidence rates for injuries, attrition, and failure to pass the final APFT. Univariate analyses served as initial filters to determine whether potential predictor variables available at or near the beginning of training could discriminate between groups of recruits with vs. without the outcomes of interest. These analyses were performed using unpaired t-tests for 28 continuous-scale potential predictor variables and Chi-square tests for 16 categorical variables. Alpha levels for

these initial univariate tests were relaxed to 0.20 to protect preferentially against Type II error at this early stage of the analysis.

Binary logistic regression analyses were then used to filter the sets of potential predictor variables further and to derive multivariate models that eliminated redundant or substantially correlated predictors, or any predictors that did not contribute meaningfully to the multivariate prediction. Potential predictors that yielded p-values < 0.20 from the t-tests and Chi-square tests were entered into the logistic regression analyses using a backward conditional stepwise procedure. Probability levels were set to 0.05 for entry and 0.10 for removal from the models. Predictors retained from stepwise procedures were then entered into forced-entry logistic regression models so that the final equations were produced with the largest available sample sizes for each model. Logits for each recruit were computed from the final logistic regression equations. Logits were transformed to predicted probabilities using the formula: Predicted Probability = $e^{2}/(1 + e^{2})$ e^{Z}), where Z = logit from the logistic regression equation. These predicted probabilities for the outcomes combined with observed occurrences or non-occurrences for injury and performance outcomes where then used to construct receiver-operating characteristic (ROC) curves. Areas under the ROC curves (AUCs) were computed to provide a general indication of prognostic performance. A minimum AUC of 0.70 was expected for a model to have minimally acceptable predictive accuracy. 15,16

Discriminant function analyses were performed to construct potential alternative models for injuries and poor performance. Estimated probabilities of injury and performance outcomes were also computed based on the derived discriminant functions, and ROC curves were constructed for these probability scales as described above.

In order to illustrate one approach to dichotomization, model-based probability of each outcome was dichotomized into higher vs. lower probability using tables of coordinate points for the ROC curves and the Youden Index.¹⁷ Predictive performance of each model dichotomized with the Youden Index was then characterized by calculation of sensitivity, specificity, positive & negative predictive values, and positive & negative likelihood ratios from a 2 x 2 contingency table containing frequency counts expressing numbers of recruits with true positive test results, false positive test results, true negative test results, and false negative test results. Tables of coordinate points for the ROC curves were then modified slightly for presentation in this technical report to display sensitivity and specificity (instead of 1-specificity), plus positive & negative likelihood ratios and Youden's Index values for comparison of sensitivity vs. specificity tradeoffs involved with selecting varying threshold values for dichotomization. IBM SPSS version 20 was used for all statistical analyses.

RESULTS

The dataset contained injury and performance outcomes for 563 recruits. Overall, average recruit age was 20.7 ± 3.8 years; 73.5% of the recruits were male. Detailed descriptive statistics for data collected at or near the beginning of training are presented in Table 2. At entry to training, men exercised with a slightly higher frequency then women, were generally more likely than women to be or to have been smokers, and were more likely to have experienced a previous musculoskeletal injury to the lower extremities.

Although the incidence of any type of injury during training was 38.0% overall, the proportion injured among males (32.1%) was significantly lower (p<0.001) than for females (54.4%). Injury rates in all 5 injury categories were significantly higher among females (p<0.001). Attrition rates were 2.2% for males and 9.4% for females (p<0.001). The rates for failure to pass the final APFT on first attempt were 6.8% for males and 15.8% for females (p=0.002). Injury rates, attrition rates, and failure of the final APFT stratified by gender are summarized in Table 3.

Table 2. Descriptive statistics for baseline demographic and performance variables.

Baseline Characteristic	Males (n=414)	Females (n=149)
Age (yr)		
	20.7 ± 4.0 (17 to 39)	20.5 ± 3.4 (17 to 35)
Height (in)*		
,	69.4 ± 2.9 (62.0 to	63.8 ± 2.7 (52.0 to
	78.0)	70.0)
Weight (lbs)*	171 0 00 7 (00 0)	1070 100 (000)
5	171.8 ± 28.7 (99.6 to 253.6)	137.8 ± 18.8 (96.6 to 187.6)
Race/Ethnicity (#, %)	Asian/Pacific Islander	Asian/Pacific Islander 8
	12 (2.9%)	(5.4%)
^	Black 56 (13.5%) Hispanic 29 (7.0%)	Black 56 (37.6%) Hispanic 17 (11.4%)
	American	American
	Indian/Alaskan Native	Indian/Alaskan Native 1
П	2 (0.5%)	(0.7%)
	White 314 (75.8%	White 66 (44.3%)
	Unknown 1 (0.2%)	Unknown 1 (0.7%)
Pushup repetitions 1-1-1 IPFT*	(0.2.0)	
	30.3 ± 14.2 (0 to 70)	14.3 ± 11.9 (0 to 47)
Situp repetitions 1-1-1 IPFT*		
	$32.3 \pm 8.5 (1 \text{ to } 53)$	28.7 ± 8.3 (2 to 50)
Run Time 1-1-1 IPFT (min)*		
	$8.0 \pm 1.3 (5.6 \text{ to } 14.0)$	9.8 ± 2.1 (6.1 to 25.0)
Passed IPFT	280 (67.6%)	91 (61.1%)
Self-reported Physical Activity Pre-	Much less active 23	Much less active 19
BCT (#, %)	(5.6%)	(12.8%)

	Somewhat less active 79 (19.1%) About the same 94 (22.7%) Somewhat more active 135 (32.6%) Much more active 69 (16.7%) Unreported 14 (3.4%)	Somewhat less active 27 (18.1%) About the same 39 (26.2%) Somewhat more active 41 (27.5%) Much more active 17 (11.4%) Unreported 6 (4.0%)
Average number of times per week (over past year) a recruit exercised or played sports for at least 30 minutes at a time*	3.9 ± 2.0 (0 to 7)	3.3 ± 1.9 (0 to 7)
Average number of times per week (over past year) a recruit ran or jogged *	3.0 ± 1.8 (0 to 7)	2.5 ± 1.9 (0 to 7)
Average number of times per week (over past year) a recruit trained with weights for at least 30 minutes* at a time	2.4 ± 2.0 (0 to 7)	1.7 ± 1.8 (0 to 7)
Number of days smoking cigarettes past 30 days	4.0 ± 8.0 (0 to 30)	2.5 ± 6.6 (0 to 30)
Smoked at least 100 cigarettes in lifetime (#, %)**	133 (33.2%)	27 (18.8%)
Any prior musculoskeletal injury to lower extremities (#, %)**	140 (34.9%)	37 (25.7%)
Prior injury index	.068 ± 0.96 (0 to 4)	.043 ± 0.86 (0 to 4)

Results are given as mean \pm SD (range) unless otherwise labeled. Reported percents are among those with valid data.

^{*}Gender differences statistically significant (p \leq 0.016) with unpaired t-tests.

^{**}Gender differences statistically significant (p \leq 0.043) with χ^2 tests.

Table 3. Injuries, attrition, and final AFPT failure by injury category for males and females.*

Outcome	Males (n=414)	Females (n=149)
≥ 1 Injury defined by CII	133 (32.1%)	81 (54.4%)
≥ 1 Injury defined by III	105 (25.4%)	74 (49.7%)
≥ 1 Injury defined by MIII	123 (29.7%)	78 (52.3%)
≥ 1 Injury defined by OII	90 (21.7%)	64 (43.0%)
≥ 1 Injury defined by TRII	70 (16.9%)	61 (40.9%)
Final APFT Failure	27 (6.8%)	21 (15.8%)
Attrition	9 (2.2%)	14 (9.4%)

^{*}Between-gender differences were statistically significant ($p \le 0.002$) for all outcomes as analyzed with Chi-square tests. Final APFT failure results are based on proportions of those who failed among those for whom outcomes were available; there were some missing values.

PREDICTIVE MODELS

Models derived with logistic regression and discriminant function analyses retained essentially the same sets of predictor variables, and resulting ROC curves were very similar – with AUCs differing by no more than 5% between model derivation methods. Where there were differences, the logistic regression models generally performed slightly better. Therefore, results of the logistic regression analyses are presented below.

When predictive models were created using multivariate logistic regression methods, the models retained from 3 to 5 predictors, with AUCs for associated ROC curves ranging from 0.671 (predicting overuse injury) to 0.815 (predicting final APFT failure). Because of missing data for some retained predictors, sample sizes for final model derivations ranged from 462 to 543. All models were statistically significant with omnibus tests of coefficients (p \leq 0.001). All models showed acceptable goodness of fit with Hosmer-Lemeshow tests being non-significant (p=0.248 to 0.828) for all models. Nagelkerke R² values for the models were relatively small, ranging from 0.105 to 0.234. Retained predictors and AUCs are presented in Table 4, with corresponding predictive equations in Tables 5 through 11. Prognostic accuracy profiles for each model are presented using cut scores determined arbitrarily at 50% probability of outcome (Table 12) and with cut scores determined by the probability of outcome associated with the maximum Youden index value (Table 13). An example of a ROC plot with cut score determined by Youden index is presented in Figure 2 for the model predicting probability of final APFT failure. Modified tables of coordinate points for all 7 ROC curves including prognostic accuracy indices for every plotted probability cut score are provided in Appendices B-H.

Table 4. Retained predictors and associated areas under the ROC curves for models created with multivariate logistic regression.

		Nagelkerke	
Outcome	Retained Predictors	R ²	AUC*
CII	Gender, Pass/Fail on 1-1-1 Test, Race/Ethnicity, Self- reported Physical Activity Pre-BCT	0.142	0.688
Ш	Gender, Run time on 1-1-1 Test, Race/Ethnicity	0.114	0.688
MIII	Gender, Run time on 1-1-1 Test, Race/Ethnicity, Self- reported Physical Activity Pre-BCT	0.148	0.692
OII	Run time on 1-1-1 Test, Height, Prior Injury Index	0.105	0.671
TRII	Gender, Smoking Duration in years, Pass/Fail on 1-1-1 Test, Race/Ethnicity, Self-reported Running Pre-BCT	0.167	0.728
Final APFT Failure	Gender, Age, Pass/Fail on 1-1-1 Test	0.234	0.815
Attrition	Pushup repetitions on 1-1-1 Test, # days smoking cigarettes past 30 days, Smoked at least 100 cigarettes in lifetime	0.157	0.782

^{*}AUC = area under the ROC curves assessing predicted probabilities (transformed from logit values computed from logistic regression equations for every subject) vs. actual status on respective outcomes.

Table 5. Predictive equation for the Comprehensive Injury Index (CII) model.

Z (CII) = -20.364 + gender + 1-1-1 IPFT result + race + physical activity pre-BCT		
Variable	Values	
Gender	Male = -0.833 Female = 0	
1-1-1 IPFT Pass/Fail Result	Passed = -0.638 Failed = 0	
Race/Ethnicity	Asian/Pacific Islander = 18.658 Black = 20.889 Hispanic = 21.016 American Indian/Alaska Native = -0.153 White = 20.670 Unknown = 0	
Self-reported Physical Activity Pre-BCT	Never = -0.467 < 1x/week = 0.357 1x/week = -0.214 2x/week = 0.634 3x/week = 0.631 4x/week = -0.132 5x/week = 0.088 6x/week = 0.402 ≥ 7x/week = 0	

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for injury.

Table 6. Predictive equation for the Installation Injury Index (III) model

Z (III) = -21.868 + gender + 1-1-1 IPFT run time + race		
Variable	Values	
Gender	Male = -0.687 Female = 0	
1-1-1 IPFT Run Time (min)	0.181 x (Run time in minutes on 1-1-1 IPFT)	
Race/Ethnicity	Asian/Pacific Islander = 18.386 Black = 20.280 Hispanic = 20.311 American Indian/Alaska Native = -0.473 White = 20.000 Unknown = 0	

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for injury.

Table 7. Predictive equation for the Modified Installation Injury Index (MIII) model.

Z (MIII) = -23.561 + gender + 1-1-1 IPFT run time + race + physical activity pre-BCT		
Variable	Values	
Gender	Male = -0.443 Female = 0	
1-1-1 IPFT Run Time (min)	0.287 x (Run time in minutes on 1-1-1 IPFT)	
Race/Ethnicity	Asian/Pacific Islander = 18.691 Black = 20.786 Hispanic = 20.656 American Indian/Alaska Native = -0.166 White = 20.590 Unknown = 0	
Self-reported Physical Activity Pre-BCT	Never = -0.636 < 1x/week = 0.463 1x/week = -0.249 2x/week = 0.453 3x/week = 0.660 4x/week = -0.117 5x/week = 0.343 6x/week = 0.666 ≥ 7x/week = 0	

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for injury.

Table 8. Predictive equation for the Overuse Injury Index (OII) model.

Z (OIII) = 2.908 + 1-1-1 IPFT run time + height + prior injury index		
Variable	Values	
1-1-1 IPFT Run Time (min)	0.271 x (Run time in minutes on 1-1-1 IPFT)	
Height (in)	-0.059 x (height in inches)	
Prior Injury Index	Index 0 = -2.426 Index 1 = -2.610 Index 2 = -1.961 Index 3 = -2.884 Index 4 = 0	

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for injury.

Table 9. Predictive equation for the Training Related Injury Index (TRII) model.

Z (TRII) = -20.192 + gender + smoking duration + 1-1-1 IPFT result + race + running pre-BCT		
Variable	Values	
Gender	Male = -1.138 Female = 0	
Smoking Duration (years)	.072 x (smoking duration in years)	
1-1-1 IPFT Pass/Fail Result	Passed = -0.430 Failed = 0	
Race/Ethnicity	Asian/Pacific Islander = 18.753 Black = 20.300 Hispanic = 20.253 American Indian/Alaska Native = 0.758 White = 19.604 Unknown = 0	
Self-reported Running Pre-BCT	Did not run or jog = -1.459 1 month or less = 0.557 2 months = -0.211 3 months = -0.087 4 to 6 months = 0.245 7 to 11 months = -0.250 1 year or more = 0	

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for injury.

Table 10. Predictive equation for the Final APFT Failure model.

Z (APFT) = 7.260 + gender + age + 1-1-1 IPFT result		
Variable	Values	
Gender	Male = -1.033 Female = 0	
Age (years)	- 0.409 x (age in years)	
1-1-1 IPFT Pass/Fail Result	Passed = -1.759 Failed = 0	

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for APFT failure.

Table 11. Predictive equation for the Attrition model.

Z (Attrition) = -2.327 + Pushups on 1-1-1 IPFT + days smoking past month + lifetime smoking at least 100 cigarettes						
Variable	Values					
Pushup Repetitions on 1-1-1 IPFT	- 0.062 x (number of pushups)					
Number of days smoking over past month	0.102 x days smoking cigarettes					
Have smoked > 100 cigarettes in lifetime	Yes = -0.994					
riave smoked 2 100 cigarettes in metime	No = 0					

Z = logit from the logistic regression equation. Logits were converted to predicted probabilities for attrition.

Table 12. Prognostic accuracy profiles for models using cut scores set to 50% probability of the outcome.

Model	Cut score	Sn	Sp	PLR	NLR	PPV	NPV
CII	≥ 50%	0.38	0.83	2.24	0.75	0.58	0.69
III	≥ 50%	0.18	0.91	1.88	0.91	0.46	0.71
MIII	≥ 50%	0.29	0.91	3.18	0.78	0.64	0.70
OII	≥ 50%	0.10	0.98	5.78	0.92	0.67	0.76
TRII	≥ 50%	0.17	0.97	5.39	0.86	0.61	0.80
Final APFT Failure*	<u>></u> 50%	0.01	1.00	10.20	0.99	0.50	0.91
Attrition*	≥ 50%	0.03	1.00	25.65	0.98	0.50	0.96

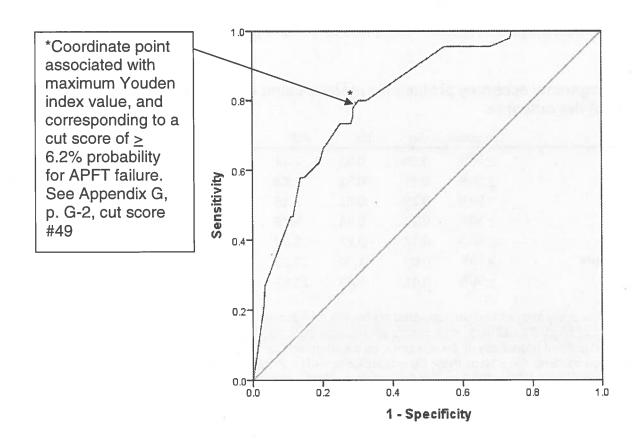
^{*}For these models every subject had an estimated probability of outcome < 50%; the contingency table was adjusted by adding 0.5 to all frequency counts when there were cells with zero counts. ¹⁶ Cut scores are in units of probability of the outcome, as transformed from logits computed from the logistic regression models. Sn = Sensitivity; Sp = Specificity; PLR = Positive Likelihood Ratio; NLR = Negative Likelihood Ratio; PPV = Positive Predictive Value; NPV = Negative Predictive Value.

Table 13. Prognostic accuracy profiles for models using cut scores determined by outcome probabilities associated with maximum Youden index values.

Model	Cut score	Sn	Sp	PLR	NLR	PPV	NPV
CII	≥ 37.2%	0.61	0.71	2.09	0.55	0.56	0.75
III	≥ 27.9%	0.64	0.67	1.93	0.54	0.47	0.80
MIII	≥ 36.2%	0.61	0.68	1.88	0.58	0.51	0.76
OII	≥ 21.6%	0.73	0.54	1.59	0.50	0.36	0.85
TRII	≥ 18.9%	0.75	0.62	1.99	0.40	0.36	0.90
Final APFT Failure	≥ 6.2%	0.80	0.70	2.64	0.29	0.20	0.97
Attrition	<u>≥</u> 2.4%	0.95	0.58	2.28	0.09	0.08	1.00

Cut scores are in units of probability of the outcome, as transformed from logits computed from the logistic regression models. Sn = Sensitivity; Sp = Specificity; PLR = Positive Likelihood Ratio; NLR = Negative Likelihood Ratio; PPV = Positive Predictive Value; NPV = Negative Predictive Value.

Figure 2. Receiver operating characteristic curve for logistic regression model predicting probability of final APFT Failure.



Area under the curve = 0.815.

DISCUSSION

Predictive models were derived using common statistical methods for the injury and performance outcomes of interest in this study. Retained predictors for the injury models were consistent with earlier work identifying gender, 3, 18-21 initial fitness levels, 18, 22, 23 prior injuries, 22 smoking, 22, 23 height, 18, 21 race/ethnicity, 21, 24, 25 and self-reports of physical activity levels prior to training 22, 26, 27 to be predictive of injuries incurred during training. None of the models performed at a level considered to provide "excellent" predictive accuracy: commonly defined as AUC values > .90.28 The injury prediction models performed relatively poorly, with AUC values from the ROC curves mostly within the range interpreted to represent "poor" prediction (AUC .60 to .70). The performance prediction models had better results, having AUC values within ranges characterized as "fair" for predicting attrition (AUC = .786) and "good" for prediction of final APFT failure (AUC = .815). Overall predictive accuracy as reflected in AUC values was consistent with previous work. For example, George et al²⁹ found an AUC of 0.64 for a logistic regression model used to predict first episode of low back pain in Soldiers undergoing combat medic training. Moran et al³⁰ reported an AUC of .765 for a pragmatic 5predictor logistic regression model to predict stress fractures in female recruits during basic training. However, those authors were able to obtain an AUC of .907 with an unwieldy 20-predictor model for the same outcome; none of the models in this study had AUCs this high.

Although self-reports of pre-BCT physical activity and pre-BCT running were included in the predictive models for injuries using the CII, MII, & TRII definitions (Tables, 5, 7, & 9 respectively), coefficients for categorical strata in these models are not consistent with results from previous studies. Several previous studies have shown with reasonable consistency that lower levels of self-reported physical activity and running pre-BCT are associated with higher injury incidence, and that higher levels of pre-BCT physical activity and running have a protective effect. 2,7,18,19 In contrast, model coefficients in this study reflect lower injury incidence at lowest and highest strata for the physical activity & running categories but higher injury incidence for recruits who reported running or engaging in physical activity at intermediate frequencies. These incongruous results may reflect differences in study samples. Whereas most previous studies reporting relatively linear relationships between pre-BCT physical activity and injury incidence were based on public health surveillance research that included virtually all recruits in a given training cycle, this current study relied on willing volunteers. Inasmuch as research volunteers in the BCT environment may differ substantially from the general population of all trainees, results from this current study should be interpreted with caution and may not be generalizable to other groups.

To the best of our knowledge, this is the first report to provide characterizations of prognostic accuracy for predictive models across the entire spectrum of possible probability cut scores. Providing coordinate points for the ROC curves allows for comparison of prognostic accuracy for any probability cut scores that might be selected to distinguish high risk subjects from low risk subjects. Selection of cut scores to distinguish between recruits estimated to have high vs. low risk for negative outcomes must be made deliberately, with a view toward protecting either against falsely

identifying a recruit as high-risk (a false positive prediction) or protecting against falsely identifying a recruit as low-risk (a false negative prediction). Cut scores yielding high sensitivity and high negative predictive values protect preferentially against false negatives: relatively few recruits would be falsely identified as low-risk. Alternately, cut scores yielding high specificity and high positive predictive values protect preferentially against false positives: relatively few recruits would be falsely identified as high-risk.

Predictive models typically demonstrate a sensitivity-specificity tradeoff: selecting a cut score yielding high sensitivity will yield relatively low specificity, and vice-versa. This tradeoff was evident in the models derived in this study, as illustrated with selections of varying cut scores for the model predicting final APFT failure (Appendix G). If the goal is to minimize false negatives we might (for example) select a sensitivity value ≥ .90, whereby no more than 1 in 10 recruits who failed the final APFT would have been falsely identified as low-risk. In order for the model to perform with a sensitivity of at least .90 we would select a cut score of .051 probability of failure (cut score #47 in Appendix G, p. G-2) -- which would categorize any recruit with an estimated probability from the model of 5.1% or greater to be at high risk for APFT failure. However, with a cut score of .051 the specificity is only .449 − such that about 55% of recruits who passed the final APFT (258 out of 468) would have been falsely identified as high-risk for failure at the beginning of training. Frequency counts and prognostic accuracy indices with a probability cut score of .051 are presented in Table 14.

Table 14. Crosstabulation with prognostic accuracy profile for final APFT prediction model using a cut score with high sensitivity: > 5.1% = high risk.

Estimated High Risk
(≥ 5.1%) for APFT Failure
(n = 301)
Estimated Low Risk
(< 5.1%) for APFT Failure
(n = 212)

Failed APFT (n = 45)	Passed APFT (n = 468)
43	258
True Positives	False Positives
2	210
False Negatives	True Negatives

Sensitivity = .956 Specificity = .449 Positive Predictive Value = .143 Negative Predictive Value = .991 Positive Likelihood Ratio = 1.733 Negative Likelihood Ratio = .099

If instead the goal is to minimize false positives, one might seek a cut score with high specificity. Illustrating again with the final APFT failure model, a cut score of .228 (cut score #61 in Appendix G, p. G-2) yields a specificity of .900, but provides a very low sensitivity of .444. This would protect relatively well against false positives among those who passed the APFT, but at the cost of a high false negative rate among those who

failed. Here, selecting for high specificity did yield the expected low false positive rate among those who passed the APFT (47/468 = 10.0%). However, given the much lower number of recruits predicted to have high risk for failure at the higher cut score of 22.8% probability, the false positive rate among all recruits estimated to have high risk for failure was quite high (47/67 = 70.1%). Frequency counts and prognostic accuracy indices with a cut score of .228 are presented in Table 15.

Table 15. Crosstabulation with prognostic accuracy profile for final APFT prediction model using a cut score with high specificity: > 22.8 % = high risk.

Estimated High Risk
(≥ 22.8%) for APFT
Failure
(n = 67)
Estimated Low Risk
(< 22.8%) for APFT
Failure
(n = 446)

	Failed APFT (n = 45)	Passed APFT (n = 468)
	20 True Positives	47 False Positives
İ	25 False Negatives	421 True Negatives

Sensitivity = .444 Specificity = .900 Positive Predictive Value = .299 Negative Predictive Value = .944 Positive Likelihood Ratio = 4.426 Negative Likelihood Ratio = .618

Studies of this nature are necessarily limited by the available data. Previous research has shown that injuries with military training are related to additional risk factors not considered in these analyses such as exercise dose, 22, 31-33 joint flexibility, 22, ^{34, 35} age of running shoe, ^{36, 37} and individual biomechanical attributes. ^{23, 38-40} Likewise, known risk factors for attrition such as mental health history and physical or sexual abuse⁴¹ were not available for analysis in this study. Future derivations of predictive models should include the full spectrum of known and suspected risk factors for negative training outcomes. Although difficult to quantify, inclusion of exercise dose in predictive models may yield higher levels of predictive accuracy. Furthermore, to the extent that measurement or estimation of biomechanical attributes of recruits is feasible, these attributes should be included in future predictive models, because inclusion of biomechanical variables has been shown to improve prediction of injuries in military training.²³ It is possible that complex modeling methods exploring nonlinear relationships among injuries, poor physical performance, exercise dose, and individual biomechanical factors may yield greater prognostic accuracy than can be obtained with common statistical procedures as employed in this study.

CONCLUSIONS

Models predicting probability of injury included known risk factors as predictors: gender, initial fitness test scores, race/ethnicity, self-reported physical activity level prior to BCT, injuries sustained prior to BCT, height, and tobacco use. Models predicting probability of APFT failure and attrition included gender, initial fitness test scores, age, and tobacco use as predictors. The models performed with levels of prognostic accuracy (defined by areas under receiver-operating characteristic [ROC] curves) considered poor to fair for predicting injury, fair for attrition, and good for APFT failure.

Results provided in this report will allow for direct comparisons with other, more complex predictive models designed to capture nonlinear relationships among injuries, poor physical performance, exercise dose, and individual biomechanical factors. When those more complex models are used to process the same data used for analyses in this report, comparisons of prognostic accuracy from the 2 types of models will permit quantification of hypothesized improvements in levels of accuracy from complex models currently under development.

RECOMMENDATIONS

Future derivations of predictive models should include the full spectrum of known and suspected risk factors for negative training outcomes. To the extent possible, future models should include as potential predictors exercise dose and measurements (or estimations) of biomechanical attributes of recruits. More complex models including nonlinear methods currently under development should be used to analyze the same data analyzed in this study in order to compare prognostic accuracy obtained with the two modeling approaches.

REFERENCES

- 1. Knapik JJ, Darakjy S, Scott S, Hauret KG, Canada S, Marin R, Palkoska F, VanCamp S, Piskator E, Rieger W, et al. Evaluation of two army fitness programs: The TRADOC standardized physical training program for basic combat training and the fitness assessment program. Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and Preventive Medicine; 2004. Report nr 12-HF-5772B-04.
- 2. Knapik JJ, Swedler D, Grier T, Hauret KG, Bullock S, Williams K, Darakjy S, Lester M, Tobler S, Jones BH. Injury reduction effectiveness of selecting running shoes based on plantar shape. J Strength Cond Res 2009 May;23(3):685-97.
- 3. Knapik J, Hauret K, Jones B. Primary prevention of injuries in initial entry training. In: MK Lenhart, DE Lounsbury, editors. *Textbook of Military Medicine: Recruit Medicine*. Washington, DC: Bordon Institute; 2006.
- 4. Knapik JJ, Hauret KG, Canada S, Marin R, Jones B. Association between ambulatory physical activity and injuries during United States army basic combat training. J Phys Act Health 2011 May;8(4):496-502.
- 5. Knapik JJ, Rieger W, Palkoska F, Van Camp S, Darakjy S. United states army physical readiness training: Rationale and evaluation of the physical training doctrine. J Strength Cond Res 2009 Jul;23(4):1353-62.
- 6. Knapik JJ, Darakjy S, Hauret KG, Canada S, Scott S, Rieger W, Marin R, Jones BH. Increasing the physical fitness of low-fit recruits before basic combat training: An evaluation of fitness, injuries, and training outcomes. Mil Med 2006 Jan;171(1):45-54.
- 7. Knapik J, Graham B, Cobbs J, Thompson D, Steelman R, Grier T, Pendergrass T, Butler N, Jones B. The soldier-athlete initiative: Program evaluation of the effectiveness of athletic trainers and musculoskeletal action teams in initial entry training, Fort Leonard Wood, June 2010-December 2011. Aberdeen Proving Ground, MD: US Army Institute of Public Health; 2012. Report nr 12-HF-OF6F-11.
- 8. Knapik JJ, Hamlet MP, Thompson KJ, Jones BH. Influence of boot-sock systems on frequency and severity of foot blisters. Mil Med 1996 Oct;161(10):594-8.
- 9. Knapik JJ, Reynolds K, Barson J. Influence of an antiperspirant on foot blister incidence during cross-country hiking. J Am Acad Dermatol 1998 Aug;39(2 Pt 1):202-6.
- 10. Knapik JJ, Marshall SW, Lee RB, Darakjy SS, Jones SB, Mitchener TA, delaCruz GG, Jones BH. Mouthguards in sport activities: History, physical properties and injury prevention effectiveness. Sports Med 2007;37(2):117-44.

- 11. Dada E. Data from the Defense Medical Surveillance System provided by the Army Institute of Public Health.
- 12. Bullock S, Jones B. Recommendations for prevention of physical training (PT)— related injuries: Results of a systematic evidence-based review by the joint services physical training injury prevention work group (JSPTIPWG). Aberdeen Proving Ground, MD: U.S. Center for Health Promotion and Preventive Medicine; 2008. Report nr 21-KK-08QR-08.
- 13. Army Physical Readiness Training, Field Manual 7-22. 2012 (26 October).
- 14. Haddon W,Jr. Energy damage and the ten countermeasure strategies. J Trauma 1973 Apr;13(4):321-31.
- 15. Randolph AG, Guyatt GH, Calvin JE, Doig G, Richardson WS. Understanding articles describing clinical prediction tools. Evidence based medicine in critical care group. Crit Care Med 1998 Sep;26(9):1603-12.
- 16. Altman DG. Diagnostic tests. In: D. G. Altman, D. Machin, T. N. Bryant, M. J. Gardner, editors. Statistics with confidence: Confidence intervals and statistical guidelines. 2nd ed. Great Britain: BMJ Books; 2000.
- 17. Youden WJ. Index for rating diagnostic tests. Cancer 1950 Jan;3(1):32-5.
- 18. Jones BH, Bovee MW, Harris JM,3rd, Cowan DN. Intrinsic risk factors for exercise-related injuries among male and female army trainees. Am J Sports Med 1993 Sep-Oct;21(5):705-10.
- 19. Knapik JJ, Sharp MA, Canham-Chervak M, Hauret K, Patton JF, Jones BH. Risk factors for training-related injuries among men and women in Basic Combat Training. Med Sci Sports Exerc 2001 Jun;33(6):946-54.
- 20. Knapik JJ, Sharp MA, Canham ML, Hauret K, Cuthie J. Injury incidence and injury risk factors among US army basic trainees at Fort Jackson, SC (including fitness training unit personnel, discharges, and newstarts). Aberdeen Proving Ground, MD: US Army Center for Health Promotion and Preventive Medicine; 1999. Report nr 29-HE-8370-99.
- 21. Knapik J, Montain SJ, McGraw S, Grier T, Ely M, Jones BH. Stress fracture risk factors in basic combat training. Int J Sports Med 2012 Nov;33(11):940-6.
- 22. Jones BH, Cowan DN, Tomlinson JP, Robinson JR, Polly DW, Frykman PN. Epidemiology of injuries associated with physical training among young men in the army. Med Sci Sports Exerc 1993 Feb;25(2):197-203.

- 23. Sharma J, Golby J, Greeves J, Spears IR. Biomechanical and lifestyle risk factors for medial tibia stress syndrome in army recruits: A prospective study. Gait Posture 2011 Mar;33(3):361-5.
- 24. Grier TL, Knapik JJ, Canada S, Canham-Chervak M, Jones BH. Risk factors associated with self-reported training-related injury before arrival at the US army ordnance school. Public Health 2010 Jul;124(7):417-23.
- 25. DeGroot DW, Castellani JW, Williams JO, Amoroso PJ. Epidemiology of U.S. army cold weather injuries, 1980-1999. Aviat Space Environ Med 2003 May;74(5):564-70.
- 26. Knapik JJ, Graham B, Cobbs J, Thompson D, Steelman R, Jones BH. A prospective investigation of injury incidence and risk factors among army recruits in combat engineer training. J Occup Med Toxicol 2013 Mar 5;8(1):5,6673-8-5.
- 27. Knapik JJ, Hauret KG, Canada S, Marin R, Jones B. Association between ambulatory physical activity and injuries during United States army basic combat training. J Phys Act Health 2011 May;8(4):496-502.
- 28. Duncan IG. Healthcare risk adjustment and predictive modeling. Winsted, CT: ACTEX Publications.
- 29. George SZ, Childs JD, Teyhen DS, Wu SS, Wright AC, Dugan JL, Robinson ME. Predictors of occurrence and severity of first time low back pain episodes: Findings from a military inception cohort. PLoS One 2012;7(2):e30597.
- Moran DS, Israeli E, Evans RK, Yanovich R, Constantini N, Shabshin N, Merkel D, Luria O, Erlich T, Laor A, et al. Prediction model for stress fracture in young female recruits during basic training. Med Sci Sports Exerc 2008 Nov;40(11 Suppl):S636-44.
- 31. Shaffer RA, Brodine SK, Almeida SA, Williams KM, Ronaghy S. Use of simple measures of physical activity to predict stress fractures in young men undergoing a rigorous physical training program. Am J Epidemiol 1999 Feb 1;149(3):236-42.
- 32. Koplan JP, Powell KE, Sikes RK, Shirley RW, Campbell CC. An epidemiologic study of the benefits and risks of running. JAMA 1982 Dec 17;248(23):3118-21.
- 33. Pollock ML, Gettman LR, Milesis CA, Bah MD, Durstine L, Johnson RB. Effects of frequency and duration of training on attrition and incidence of injury. Med Sci Sports 1977 Spring;9(1):31-6.
- 34. Knapik JJ, Jones BH, Bauman CL, Harris JM. Strength, flexibility and athletic injuries. Sports Med 1992 Nov;14(5):277-88.

- 35. Knapik JJ, Bauman CL, Jones BH, Harris JM, Vaughan L. Preseason strength and flexibility imbalances associated with athletic injuries in female collegiate athletes. Am J Sports Med 1991 Jan-Feb;19(1):76-81.
- 36. Gardner LI,Jr, Dziados JE, Jones BH, Brundage JF, Harris JM, Sullivan R, Gill P. Prevention of lower extremity stress fractures: A controlled trial of a shock absorbent insole. Am J Public Health 1988 Dec;78(12):1563-7.
- 37. Cook SD, Kester MA, Brunet ME. Shock absorption characteristics of running shoes. Am J Sports Med 1985 Jul-Aug;13(4):248-53.
- 38. Cowan DN, Jones BH, Robinson JR. Foot morphologic characteristics and risk of exercise-related injury. Arch Fam Med 1993 Jul;2(7):773-7.
- 39. Kaufman KR, Brodine SK, Shaffer RA, Johnson CW, Cullison TR. The effect of foot structure and range of motion on musculoskeletal overuse injuries. Am J Sports Med 1999 Sep-Oct;27(5):585-93.
- 40. Cowan DN, Jones BH, Frykman PN, Polly DW, Jr, Harman EA, Rosenstein RM, Rosenstein MT. Lower limb morphology and risk of overuse injury among male infantry trainees. Med Sci Sports Exerc 1996 Aug;28(8):945-52.
- 41. Knapik JJ, Jones BH, Hauret KG, Darakjy S, Piskator G. A review of the literature on attrition from the military services: Risk factors and strategies to reduce attrition. Aberdeen Proving Ground, MD: US Army Center for Health Promotion and Preventive Medicine; 2004. Report nr 12-HF-01Q9A-04.

Appendix A: Questionnaire Administered to Soldiers on Entry at Basic Combat Training

Physical Activity in Basic Combat Training (2010): New Soldier Survey

Authority:

32 CFR 219, AR 70-25, and EO 9397

Principle Purpose:

Social Security Number (SSN) and name will be used to obtain information about your medical visits and injuries and Army Physical

Fitness Test scores from Defense database systems.

Routine Uses:

The SSN and home address will be used for identification purposes and for research and evaluation only. Information derived from the study will

be not be used outside of the Department of Defense.

Disclosure:

The furnishing of your name and SSN is required. Failure to provide the information may disqualify you from participating in this research study.

PLEASE READ ALL DIRECTIONS AND QUESTIONS CAREFULLY.

- Answer all questions to the best of your recollection.
- Ask research staff for help if you need it.
- Fill numbers in the boxes below, then fill in the corresponding bubbles.

	Social Security Number									
			_			_				
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1	1	1		1	1		1	1	1	1
2	2	2		2	2		2	2	2	2
3	3	3		3	3		3	3	3	3
4	4	4		4	ຝ		4	4	(4)	4
(5)	(5)	(5)		(5)	(5)		(5)	(5)	(5)	(5)
<u>(a)</u>	6	6		6	6		(B)	6	6	6
7	7	7		7	7		7	7	7	7
8	8	$_{f B}$		9	8		(8)	8	9	€
9	9	9		9	9		3	9	9	(§)

What is your name?	
(last name, first name, middle initial)	

ABOUT YOU

1. Subject #

- 0 0 0 0
- 0 0 0
- 2 2 2 2
- 3 3 3 3
- 4 4 4
- 5 5 5
- 6 6 6 6
- 7 7 7
- 8 8 8
- 9 9 9 9

2.Height inches	3. Weight pounds

- 0 0 0 0
- 0 0 0 0
- 2 2 2 2 2
- 3 3 3 3
- 44
- 5 5 5
- 6 6 6
- 0 0 0 0
- (B) (B) (B)
 - 9 9

ABOUT YOU

	4. Today's Date								
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	3	3	3						
	4		4						
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	6		6						
	7		7						
	8		8						
	9		9						

	5. Your Birth Date							
Mo	nth	D	ay		Ye	ear		
				1	9			
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	2	2	2	2	2	2	2	
	3	3	3	3	3	3	3	
	4		4	4	4	4	4	
	(5)		(5)	(5)	(5)	(5)	(5)	
	6		6	6	6	6	6	
	7		7	7	7	7	7	
	8		(8)	(8)	8	8	9	
	9		9	9		9	9	

6. Gender		
Are you male or female?	M	F

TO	В	A	С	CO	U	IS	E

7. Have you smoked at least 100 cigarettes in your life? (100 cigaret Yes 💮	tes = 5 packs)
No ®	
<u> </u>	
8. How old were you when you smoked a whole cigarette for the first time? (If you have never smoked a whole cigarette, write 00 and mark 00 in the bubbles provided below)	
Years Old	
© ©	
① ①	
9 9	
9 9	
②②②	
⑤ .	
©	
© ©	
@	
9	3.
9. During the past 30 days, how many days did you smoke a cigarette?	1
(If you never smoked or not smoked in the last 30 days, write 00 and	72
mark 00 in the bubbles provided below) Days	l .
Duys	
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3 3	
③	
<u> </u>	
6	
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you ne	ver smoked or		id you smoke <u>per</u> day? (If 30 days, write 00 and
1111111111	Cigarettes	les provided belowy	
		I	
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2 2			
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4 4			
5 5			
6 6			
7)		
8 8)		
9 9)		
you qu	it? (If you nev 00 in the bubb		how many months ago did rent smoker, write 00 and
you qu	it? (If you nev	er smoked or are a cur	
you qu mark	oft? (If you new 00 in the bubb Months	er smoked or are a cur	
you qu mark	oit? (If you new 00 in the bubb Months	er smoked or are a cur	
you qu mark	oit? (If you nev.	er smoked or are a cur	
9 0 0 1 1 2 2 2	it? (If you new oo in the bubb Months	er smoked or are a cur	
9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	it? (If you nev. 00 in the bubb Months	er smoked or are a cur	
90 Qu mark 90 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	it? (If you new oo in the bubb Months	er smoked or are a cur	
9 © 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	it? (If you new oo in the bubb Months	er smoked or are a cur	
90 Qu qu mark 0 0 0 1 1 2 2 3 3 4 4 5 6 6	it? (If you new oo in the bubb Months))))	er smoked or are a cur	
9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	it? (If you new oo in the bubb Months	er smoked or are a cur	
90 Qu qu mark 0 0 0 1 1 2 2 3 3 4 4 5 6 6	it? (If you new oo in the bubb Months	er smoked or are a cur	

PHYSICAL ACTIVITY

	d to others your same age and sex, how would you rate yourself as to the amount of physical performed prior to entering basic training?
\circ	Much less active
\circ	Somewhat less active
\circ	About the same
\circ	Somewhat more active
\circ	Much more active
	last 2 months, what was the average number of time per week you exercised or played least 30 minutes at a time?
\circ	Never
\circ	Less than 1 time per week
\circ	1 time per week
0	2 times per week
\circ	3 times per week
	4 times per week
0	5 times per week
\circ	6 times per week
\circ	7 times or more per week
14. Over the	last 2 months, how many times per week did you run or jog?
\circ	Never
0	Less than 1 time per week
\circ	1 time per week
\circ	2 times per week
\circ	3 times per week
\circ	4 times per week
\circ	5 times per week
\circ	6 times per week
0	7 times or more per week
15. How long	g were you running or jogging before you entered basic training?
0	Did not run or jog
0	1 month or less
0	2 months
0	3 months
0	4 to 6 months
0	7 to 11 months
0	1 year or more

16. Over the	last 2 months, how many times per week did you perform weight training exercises?
\circ	Never
\circ	Less than 1 time
\circ	1 time
\circ	2 times
\circ	3 times
\circ	4 times
\circ	5 times
0000000	6 times
\circ	7 times or more
	rformed weight training in the last 2 months, how long have you been doing this?
\circ	Did not weight train
\circ	1 month or less
\circ	2 months
0	3 months
Ō	4 to 6 months
000000	7 to 11 months
0	1 year or more
17.	INJURY HISTORY
	ATTOTAL AND TOTAL
18. Have you	a ever injured bone, muscle, tendon, ligaments, and/or cartilage in one or both of your lower
limbs, ankles	s, or feet?
limbs, ankles	yes
limbs, ankles	s, or feet?
N 19. Did any	yes No
limbs, ankles (v) (N) 19. Did any one week?	yes No of these injuries prevent you from participating in your normal physical activities for at least
limbs, ankles (Y) (N) 19. Did any one week? (Y)	Yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N)	yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N)	Yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin	yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities?	Yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities?	yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical Does not apply, never been injured
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities? (Y)	Yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical Does not apply, never been injured Yes
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities? (Y)	Yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical Does not apply, never been injured Yes
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities? (Y)	Yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical Does not apply, never been injured Yes
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities? (Y)	Yes No Of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical Does not apply, never been injured Yes No If you are a man, stop here and wait for further instructions.
limbs, ankles (Y) (N) 19. Did any one week? (Y) (N) 20. Followin activities? (Y)	yes No of these injuries prevent you from participating in your normal physical activities for at least Does not apply, never been injured Yes No g these injuries, were you able to eventually return to 100% of your normal physical Does not apply, never been injured Yes No

WOMEN ONLY: MENSTRUAL HISTORY

		vhat age d rite <mark>00 an</mark>						ot had a m w)	enstrual	a
		Years C								
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22	Duni	na tha laa	+ 12 ma	entho h	asia vou e	a ror micro	ad siv or	more month	in a row	between menstrual
	les?	ing the las	1 12 mc	iiuis, i	lave you c	vei iiiiss	ou six oi	more <u>mona</u>	13 III & 10 W	between mensular
			I have	never	had a men	istrual pe	riod			
	(enstrual cycles
	Y		-					row between		•
24.			months,	have	you taken	birth con	trol pills	or any othe	r hormona	l therapy?
	(Yes							
	(ט	No							

25. If you have ever been pregnant, how long (years and months) ago were you last pregnant (If you have never been pregnant, write 00 and mark 00 in the bubbles provided below)

		Years			Months
<u> </u>	6		_	<u> </u>	
0	0		0	0	
1	1		1	1	
2	2			2	
	3			3	
	4			4	
	5			5	
	6			6	
	7			7	
	8			8	
	9			9	

Stop here and wait for further instructions. Thank you!

Question # 26 & 27 below to be filled out by Research Staff ONLY.

l .	eight hes	27. Weight pounds				
0	0	0	0	0		
1	1	1	1	1		
2	2	(ž)	2	2		
3	3	3	3	3		
4	4		· 👍	4		
5	(5)		(5)	(5)		
6	6		6	6		
7	7		7	7		
(8)	8		8	8		
	9		9	9		

Appendix B: Prognostic Indexes for Model Predicting Injuries Defined by the Comprehensive Injury Index

Cut	Positive if	Sensitivity	Specificity	Positíve	Negative	Youden's Index
Score	Probability of		l I	Likelihood Ratio	Likelihood Ratio	
#	Outcome					
	Greater Than or					
	Equal To					
1	.00000	1.000	.000			.000
2 ,	.00000	1.000	.003			.003
3	.00000	1.000	.006		•	.006
4	.00000	1.000	.009			.009
5	.01276	1.000	.012			.012
6	.02906	1.000	.018			.018
7	.03395	1.000	.024			.024
8	.04702	1.000	.028			.028
9	.05936	1.000	.034			.034
10	.06647	1.000	.037			.037
11	.08029	1.000	.043			.043
12	.10412	1.000	.046			.046
13	.12496	1.000	.049			.049
14	.12945	1.000	.052			.052
15	.13344	.995	.052	1.05	.10	.047
16	.14504	.995	.055	1.05	.09	.050
17	.15306	.995	.058	1.06	.09	.053
18	.15852	.990	.061	1.05	.16	.051
19	.18258	.985	.064	1.05	.23	.049
20	.20375	.970	.098	1.08	.31	.068
21	.21045	.970	.101	. 1.08	.30	.071
22	.22639	.940	.202	1.18	.30	.142
23	.23847	.894	.278	1.24	.38	.173
24	.24650	.894	.281	1.24	.38	.176
25	.25415	.889	.291	1.25	.38	.180
26	.25468	.819	.379	1.32	.48	.198
27	.25894	.819	.382	1.33	.47	.201
28	.26655	.814	.382	1.32	.49	.196
29	.27458	.809	.385	1.32	.50	.194
30	.27939	.809	.391	1.33	.49	.200
31	.28896	.804	.407	1.36	.48	.211
32	.30209	.799	.428	1.40	.47	.227

33	.30743	.799	.431	1.40	.47	.230
34	.31215	.784	.443	1.41	.49	.227
35	.31699	.784	.450	1.42	.48	.233
36	.32067	.754	.492	1.48	.50	.246
37	.32408	.734	.511	1.50	.52	.244
38	.33309	.729	.526	1.54	.52	.255
39	.34914	.704	.554	1.58	.54	.257
40	.35822	.704	.560	1.60	.53	.263
41	.36312	.704	.563	1.61	.53	.266
42	.36733	.704	.569	1.63	.52	.272
43	.36875	.693	.572	1.62	.54	.265
44	.37026	.633	.645	1.78	.57	.278
45	.37102	.613	.691	1.98	.56	.304
46	.37202	.608	.709	2.09	.55	.318
47	.37938	.603	.709	2.08	.56	.312
48	.38898	.583	.725	2.12	.58	.308
49	.39196	.578	.734	2.17	.58	.312
50	.39483	.548	.749	2.18	.60	.297
51	.40776	.548	.752	2.21	.60	.300
52	.41859	.538	.758	2.23	.61	.296
53	.42073	.533	.761	2.23	.61	.294
54	.42232	.513	.774	2.26	.63	.286
55	.42274	.508	.777	2.27	.63	.284
56	.42342	.497	.777	2.23	.65	.274
57	.43149	.487	.777	2.18	.66	.264
58	.43929	.462	.783	2.13	.69	.245
59	.44238	.437	.795	2.13	.71	.232
60	.44938	.432	.804	2.21	.71	.236
61	.45383	.427	.804	2.18	.71	.231
62	.45464	.422	.804	2.16	.72	.226
63	.45646	.417	.807	2.16	.72	.224
64	.46347	.402	.810	2.12	.74	.212
65	.47053	.392	.820	2.17	.74	.212
66	.47442	.382	.820	2.12	.75	.201
67	.48537	.382	.826	2.19	.75	.208
68	.50428	.377	.832	2.24	.75	.209
69	.51622	.367	.835	2.22	.76	.202
70	.52045	.362	.844	2.32	.76	.206
71	.52465	.352	.853	2.40	.76	.205
72	.52659	.307	.881	2.57	.79	.187

73	.53519	.271	.899	2.69	.81	.170
74	.54375	.266	.899	2.64	.82	.165
75	.54519	.261	.899	2.59	.82	.160
76	.55076	.261	.902	2.67	.82	.163
77	.55813	.251	.902	2.57	.83	.153
78	.56652	.246	.908	2.68	.83	.154
79	.57321	.241	.911	2.72	.83	.153
80	.57480	.221	.927	3.01	.84	.148
81	.57560	.201	.933	2.99	.86	.134
82	.57664	.201	.936	3.13	.85	.137
83	.57878	.196	.939	3.20	.86	.135
84	.58067	.186	.942	3.20	.86	.128
85	.58651	.176	.942	3.03	.87	.118
86	.59447	.176	.945	3.20	.87	.121
87	.59713	.171	.945	3.10	.88	.116
88	.60001	.171	.948	3.29	.87	.119
89	.60533	.166	.948	3.19	.88	.114
90	.60935	.166	.951	3.39	.88	.117
91	.61120	.161	.957	3.76	.88	.118
92	.61924	.156	.963	4.24	.88	.119
93	.62728	.131	.969	4.27	.90	.100
94	.62804	.116	.976	4.72	.91	.091
95	.63853	.116	.979	5.40	.90	.094
96	.65234	.116	.985	7.56	.90	.100
97	.65641	.106	.985	6.90	.91	.090
98	.65715	.101	.985	6.57	.91	.085
99	.66724	.095	.985	6.24	.92	.080
100	.69218	.085	.985	5.59	.93	.070
101	.71297	.080	.988	6.57	.93	.068
102	.71890	.060	.991	6.57	.95	.051
103	.72609	.045	.991	4.93	.96	.036
104	.73729	.040	.991	4.38	.97	.031
105	.75116	.035	.991	3.83	.97	.026
106	.76099	.020	.991	2.19	.99	.011
107	.77215	.005	1.000			.005
108	1.00000	.000	1.000			.000

Appendix C: Prognostic Indexes for Model Predicting Injuries Defined by the Installation Injury Index

Cut	Positive if	Sensitivity	Specificity	Positive	Negative	Youden's Index
Score	Probability of			Likelihood Ratio	Likelihood Ratio	
#	Outcome					-
	Greater Than or					
	Equal To					
1 =	.00000	1.000	.000		•	.000
2	.00000	1.000	.003			.003
3	.00000	1.000	.005	- ·		.005
4	.00000	1.000	.008			.008
5	.02430	1.000	.011			.011
6	.05065	1.000	.013			.013
7	.05384	1.000	.016			.016
8	.05504	1.000	.019			.019
9	.05580	1.000	.021			.021
10	.05662	1.000	.024			.024
11	.05745	1.000	.027			.027
12	.05828	1.000	.029			.029
13	.05868	1.000	.032			.032
14	.06000	1.000	.035			.035
15	.06604	1.000	.038			.038
16	.07627	.994	.038	1.03	.16	.032
17	.08932	.994	.040	1.04	.15	.034
18	.11191	.994	.043	1.04	.14	.037
19	.13325	.994	.046	1.04	.13	.040
20	.14407	.994	.048	1.04	.12	.042
21	.15361	.988	.048	1.04	.24	.036
22	.16012	.988	.051	1.04	.23	.039
23	.16909	.988	.054	1.04	.22	.042
24	.17725	.988	.056	1.05	.21	.045
25	.18196	.988	.059	1.05	.20	.047
26	.18641	.988	.062	1.05	.19	.050
27	.18682	.988	.064	1.06	.18	.053
28	.18751	.988	.070	1.06	.17	.058
29	.18861	.988	.072	1.07	.16	.061
30	.19000	.988	.075	1.07	.16	.063
31	.19126	.988	.078	1.07	.15	.066
32	.19294	.988	.083	1.08	.14	.071

	10470	000	000	4 00	ا م	
33	.19478	.988	.088	1.08	.13	.077
34	.19578	.988	.091	1.09	.13	.079
35	.19620	.988	.094	1.09	.13	.082
36	.19663	.982	.094	1.08	.19	.076
37	.19735	.982	.099	1.09	.18	.082
38	.19807	.982	.102	1.09	.17	.084
39	.19951	.982	.107	1.10	.16	.090
40	.20096	.976	.107	1.09	.22	.084
41	.20154	.976	.113	1.10	.21	.089
42	.20198	.976	.115	1.10	.20	.092
43	.20271	.971	.115	1.10	.26	.086
44	.20344	.971	.118	1.10	.25	.089
45	.20388	.965	.121	1.10	.29	.085
46	.20462	.965	.126	1.10	.28	.091
47	.20535	.965	.134	1.11	.26	.099
48	.20594	.965	.137	1.12	.26	.101
49	.20639	. 965	.147	1.13	.24	.112
50	.20683	.965	.150	1.14	.24	.115
51	.20758	.965	.153	1.14	.23	.118
52	.20832	.965	.161	1.15	.22	.126
53	.20892	.965	.166	1.16	.21	.131
54	.20937	.965	.172	1.16	.21	.136
55	.20982	.965	.174	1.17	.20	.139
56	.21057	.959	.177	1.16	.23	.136
57	.21132	.959	.185	1.18	.22	.144
58	.21193	.953	.193	1.18	.24	.146
59	.21268	.953	.196	1.18	.24	.149
60	.21344	.947	.201	1.19	.26	.148
61	.21389	.947	.206	1.19	.26	.153
62	.21511	.947	.209	1.20	.25	.156
63	.21665	.941	.214	1.20	.27	.156
64	.21742	.929	.223	1.20	.32	.152
65	.21819	.929	.228	1.20	.31	.157
66	.21896	.929	.241	1.22	.29	.171
67	.21958	.929	.249	1.24	.28	.179
68	.22005	.924	.249	1.23	.31	.173
69	.22083	.924	.252	1.23	.30	.176
70	.22192	.924	.260	1.25	.29	.184
71	.22317	.924	.265	1.26	.29	.189
72	.22427	.924	.282	1.29	.27	.205
•	•	•				•

1 [1	1	1	1	1	22
73	.22474	.924	.284	1.29	.27	.208
74	.22522	.918	.287	1.29	.29	.205
75	.22585	.912	.287	1.28	.31	.199
76	.22632	.912	.290	1.28	.30	.201
77	.22680	.912	.303	1.31	.29	.215
78	.22744	.912	.306	1.31	.29	.217
79	.22784	.912	.308	1.32	.29	.220
80	.22831	.912	.311	1.32	.28	.223
81	.22903	.912	.324	1.35	.27	.236
82	.22951	.900	.332	1.35	.30	.232
83	.22999	.894	.335	1.34	.32	.229
84	.23055	.882	.340	1.34	.35	.223
85	.23082	.882	.343	1.34	.34	.226
86	.23090	.882	.346	1.35	.34	.228
87	.23144	.882	.351	1.36	.33	.234
88	.23220	.859	.365	1.35	.39	.223
89	.23253	.859	.367	1.36	.38	.226
90	.23273	.859	.370	1.36	.38	.229
91	.23321	.853	.375	1.37	.39	.228
92	.23382	.847	.381	1.37	.40	.228
93	.23415	.847	.383	1.37	.40	.230
94	.23435	.847	.391	1.39	.39	.238
95	.23483	.847	.394	1.40	.39	.241
96	.23548	.847	.397	1.40	.39	.244
97	.23597	.841	.402	1.41	.39	.243
98	.23646	.841	.405	1.41	.39	.246
99	.23728	.841	.408	1.42	.39	.249
100	.23810	.841	.413	1.43	.38	.254
101	.23876	.841	.426	1.47	.37	.267
102	.23957	.841	.432	1.48	.37	.273
103 🏻	.24007	.841	.434	1.49	.37	.275
104	.24057	.835	.437	1.48	.38	.272
105	.24140	.835	.440	1.49	.37	.275
106	.24223	.829	.445	1.49	.38	.274
107	.24306	.829	.448	1.50	.38	.277
108	.24373	.824	.450	1.50	.39	.274
109	.24423	.824	.453	1.51	.39	.277
110	.24507	.824	.456	1.51	.39	.279
111	.24590	.800	.458	1.48	.44	.258
112	.24633		.461	1.48	.43	.261

113	.24666	.800	.464	1.49	.43	.264
114	.24708	.800	.469	1.51	.43	.269
115	.24759	.788	.477	1.51	.44	.265
116	.24809	.788	.480	1.52	.44	.268
117	.24894	.782	.488	1.53	.45	.270
118	.24970	.782	.491	1.54	.44	.273
119	.25004	.782	.493	1.54	.44	.276
120	.25063	.759	.493	1.50	.49	.252
121	.25148	.759	.496	1.51	.49	.255
122	.25217	.759	.509	1.55	.47	.268
123	.25268	.759	.517	1.57	.47	.276
124	.25319	.741	.517	1.54	.50	.259
125	.25388	.741	.520	1.54	.50	.261
126	.25473	.741	.523	1.55	.50	.264
127	.25559	.741	.525	1.56	.49	.267
128	.25611	.735	.531	1.57	.50	.266
129	.25663	.735	.534	1.58	.50	.269
130	.25828	.735	.539	1.59	.49	.274
131	.25966	.735	.542	1.60	.49	.277
132	.26010	.729	.544	1.60	.50	.274
133	.26071	.718	.550	1.59	.51	.267
134	.26106	.712	.552	1.59	.52	.264
135	.26123	.712	.558	1.61	.52	.269
136	.26141	.712	.560	1.62	.51	.272
137	.26180	.712	.566	1.64	.51	.277
138	.26215	.712	.568	1.65	.51	.280
139	.26246	.706	.574	1.66	.51	.280
140	.26281	.700	.574	1.64	.52	.274
141	.26307	.694	.579	1.65	.53	.273
142	.26351	.694	.584	1.67	.52	.279
143	.26421	.694	.587	1.68	.52	.281
144	.26509	.688	.587	1.67	.53	.275
145	.26562	.688	.590	1.68	.53	.278
146	.26606	.676	.598	1.68	.54	.274
147	.26659	.676	.601	1.69	.54	.277
148	.26704	.676	.603	1.70	.54	.280
149	.26766	.676	.606	1.72	.53	.282
150	.26855	.676	.609	1.73	.53	.285
151	.26962	.676	.611	1.74	.53	.288
152	.27055	.676	.617	1.76	.52	.293

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153	.27100	.676	.619	1.78	.52	.296
154	.27131	.671	.622	1.77	.53	.293
155	.27216	.671	.625	1.79	.53	.295
156	.27279	.671	.627	1.80	.53	.298
157	.27315	.671	.635	1.84	.52	.306
158	.27351	.665	.635	1.82	.53	.300
159	.27364	.659	.635	1.81	.54	.294
160	.27382	.653	.635	1.79	.55	.288
161	.27405	.653	.638	1.80	.54	.291
162	.27441	.653	.641	1.82	.54	.294
163	.27499	.653	.643	1.83	.54	.296
164	.27545	.653	.646	1.85	.54	.299
165	.27563	.647	.646	1.83	.55	.293
166	.27644	.641	.646	1.81	.56	.287
167	.27726	.641	.649	1.83	.55	.290
168	.27744	.641	.651	1.84	.55	.293
169	.27789	.641	.665	1.91	.54	.306
170	.27862	.641	.668	1.93	.54	.309
171	.27953	.635	.668	1.91	.55	.303
172	.28044	.629	.668	1.89	.56	.297
173	.28099	.629	.670	1.91	.55	.300
174	.28154	.618	.670	1.87	.57	.288
175	.28218	.612	.670	1.86	.58	.282
176	.28448	.606	.670	1.84	.59	.276
177	.28660	.606	.673	1.85,	.59	.279
178	.28702	.600	.676	1.85	.59	.276
179	.28739	.594	.676	1.83	.60	.270
180	.28790	.594	.678	1.85	.60	.272
181	.28860	.594	.684	1.88	.59	.278
182	.28897	.594	.686	1.89	.59	.280
183	.28948	.594	.689	1.91	.59	.283
184	.28994	.588	.689	1.89	.60	.277
185	.29022	.588	.692	1.91	.60	.280
186	.29069	.582	.692	1.89	.60	.274
187	.29106	.576	.694	1.89	.61	.271
188	.29200	.576	.700	1.92	.61	.276
189	.29340	.571	.700	1.90	.61	.270
190	.29443	.571	.702	1.92	.61	.273
191	.29547	.571	.705	1.93	.61	.276
192	.29679	.565	.705	1.91	.62	.270
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193	.29811	.565	.708	1.93	.62	.272
194	.29901	.565	.710	1.95	.61	.275
195	.29958	.559	.710	1.93	.62	.269
196	.30049	.559	.713	1.95	.62	.272
197	.30120	.553	.713	1.93	.63	.266
198	.30129	.553	.716	1.95	.62	.269
199	.30144	.553	.718	1.96	.62	.271
200	.30297	.553	.721	1.98	.62	.274
201	.30478	.547	.721	1.96	.63	.268
202	.30550	.541	.721	1.94	.64	.262
203	.30680	.541	.724	1.96	.63	.265
204	.30800	.541	.727	1.98	.63	.268
205	.30854	.535	.729	1.98	.64	.265
206	.30984	.535	.732	2.00	.63	.267
207	.31188	.529	.732	1.97	.64	.261
208	.31397	.529	.735	1.99	.64	.264
209	.31514	.524	.737	1.99	.65	.261
210	.31621	.518	.743	2.01	.65	.260
211	.31857	.518	.745	2.03	.65	.263
212	.32123	.512	.745	2.01	.66	.257
213	.32311	.512	.748	2.03	.65	.260
214	.32419	.512	.751	2.05	.65	.262
215	.32479	.506	.751	2.03	.66	.257
216	.32499	.500	.751	2.01	.67	.251
217	.32687	.500	.753	2.03	.66	.253
218	.33077	.494	.753	2.00	.67	.247
219	.33329	.494	.756	2.03	.67	.250
220	.33379	.488	.756	2.00	.68	.244
221	.33484	.488	.759	2.02	.67	.247
222	.33620	.488	.761	2.05	.67	.250
223	.33686	.488	.764	2.07	.67	.252
224	.33726	.488	.767	2.09	.67	.255
225	.33767	.482	.767	2.07	.68	.249
226	.33995	.476	.769	2.07	.68	.246
227	.34290	.476	.772	2.09	.68	.249
228	.34531	.476	.775	2.12	.68	.251
229	.34704	.476	.777	2.14	.67	.254
230	.34745	.471	.777	2.11	.68	.248
231	.34889	.471	.780	2.14	.68	.251
232	.35048	.471	.783	2.17	.68	.253

1000	.35245	465	.783	2.14	.68	.248
233		.465 .465	l	2.14	.68	.250
234	.35524	1	.786	T	.68	.256
235	.35669	.465	.791	2.22	.67	
236	.35701	.465	.794	2.25	1	.258
237	.35768	.459	.794	2.22	.68	.252
238	.36149	.459	.796	2.25	.68	.255
239	.36546	.453	.796	2.22	.69	.249
240	.36646	.447	.796	2.19	.69	.243
241	.36725	.441	.796	2.17	.70	.237
242	.36798	.441	.799	2.19	.70	.240
243	.36883	.441	.802	2.22	.70	.243
244	.37020	.441	.804	2.25	.69	.245
245	.37093	.441	.807	2.29	.69	.248
246	.37156	.441	.810	2.32	.69	.251
247	.37252	.441	.812	2.35	.69	.254
248	.37359	.441	.815	2.38	.69	.256
249	.37464	.435	.815	2.35	.69	.250
250	.37623	.435	.818	2.39	.69	.253
251	.37777	.429	.818	2.36	.70	.247
252	.37905	.424	.818	2.32	.70	.241
253	.38081	.418	.818	2.29	.71	.235
254	.38198	.418	.820	2.33	.71	.238
255	.38295	.406	.820	2.26	.72	.226
256	.38466	.400	.820	2.23	.73	.220
257	.38578	.394	.820	2.19	.74	.214
258	.38696	.388	.820	2.16	.75	.209
259	.38889	.388	.823	2.19	.74	.211
260	.39030	.388	.826	2.23	.74 .74	.214 .217
261	.39100	.388	.828	2.26		.217
262	.39165 .39434	.382	.828	2.23 2.19	.75 .75	.205
263		.376 .376	.831	2.19	.75	.208
264	.39716 .39781	.371	.831	2.23	.76	.202
265 266	.39814	.371	.834	2.13	.75	.204
		.371	.836	2.27	.75	.207
267	.39862		.839	2.27	.75	.207
268	.40080	.371	.839	2.30	.75	.210
269	.40292	.365	.839	2.27	.75	.204
270	.40346	.365	.845	2.31	.75	.207
271	.40465	.365	l .	1	.75	
272	.40596	.359	.845	2.31	./6	.203

273	.40804	.359	.847	2.35	.76	.206
274	.41286	.359	.850	2.39	.75	.209
275	.41659	.359	.853	2.43	.75	.211
276	.41725	.353	.853	2.39	.76	.205
277	.41791	.353	.855	2.44	.76	.208
278	.42216	.347	.855	2.40	.76	.202
279	.42613	.341	.855	2.36	.77	.196
280	.42896	.341	.858	2.40	.77	.199
281	.43218	.335	.861	2.41	.77	.196
282	.43335	.329	.861	2.36	.78	.190
283	.43427	.329	.863	2.41	.78	.193
284	.43466	.324	.863	2.37	.78	.187
285	.43830	.312	.863	2.28	.80	.175
286	.44298	.312	.866	2.33	.79	.178
287	.44611	.306	.866	2.28	.80	.172
288	.44812	.300	.866	2.24	.81	.166
289	.44869	.294	.866	2.19	.82	.160
290	.44936	288	.866	2.15	.82	.154
291	.45059	.288	.869	2.19	.82	.157
292	.45227	.276	.869	2.10	.83	.145
293	.45339	.271	.869	2.06	.84	.139
294	.45507	.271	.871	2.10	.84	.142
295	.45721	.271	.874	2.15	.83	.145
296	.45991	.265	.874	2.10	.84	.139
297	.46293	.259	.874	2.05	.85	.133
298	.46800	.259	.877	2.10	.85	.135
299	.47286	.253	.877	2.05	.85	.130
300	.47410	.247	.877	2.00	.86	.124
301	.47522	.241	.877	1.96	.87	.118
302	.47805	.241	.879	2.00	.86	.121
303	.48004	.241	.882	2.04	.86	.123
304	.48173	.241	.885	2.09	.86	.126
305	.48369	.241	.887	2.14	.86	.129
306	.48471	.235	.887	2.09	.86	.123
307	.48539	.235	.890	2.14	.86	.125
308	.48663	.224	.890	2.03	.87	.114
309	.48833	.218	.890	1.98	.88	.108
310	.48901	.212	.890	1.93	.89	.102
311	.48957	.212	.893	1.97	.88	.105
312	.49059	.212	.895	2.03	.88	.107

313	.49127	.206	.895	1.97	.89	.101
314	.49228	.206	.898	2.02	.88	.104
315	.49342	.200	.898	1.96	.89	.098
316	.49398	.194	.901	1.96	.89	.095
317	.49454	.194	.903	2.01	.89	.098
318	.49533	.188	.903	1.95	.90	.092
319	.49676	.182	.903	1.89	.90	.086
320	.49834	.182	.906	1.94	.90	.089
321	.50201	.176	.906	1.88	.91	.083
322	.50597	.176	.909	1.94	.91	.085
323	.50756	.171	.909	1.87	.91	.079
324	.50846	.165	.909	1.81	.92	.074
325	.50999	.165	.912	1.86	.92	.076
326	.51135	.159	.912	1.80	.92	.070
327	.51423	.159	.914	1.85	.92	.073
328	.51745	.159	.917	1.91	.92	.076
329	.51802	.159	.920	1.97	.91	.078
330	.51875	.159	.922	2.04	.91	.081
331	.51982	.159	.925	2.12	.91	.084
332	.52248	.153	.925	2.04	.92	.078
333	.52479	.147	.925	1.96	.92	.072
334	.52602	.141	.925	1.88	.93	.066
335	.52772	.141	.928	1.95	.93	.069
336	.52981	.135	.928	1.87	.93	.063
337	.53173	.129	.928	1.79	.94	.057
338	.53319	.124	.928	1.71	.94	.051
339	.53578	.124	.930	1.77	.94	.054
340	.53781	.118	.930	1.69	.95	.048
341	.53904	.118	.933	1.76	.95	.051
342	.54005	.118	.936	1.83	.94	.053
343	.54045	.112	.936	1.74	.95	.047
344	.54225	.106	.936	1.65	.96	.042
345	.54444	.106	.938	1.72	.95	.044
346	.54494	.106	.941	1.80	.95	.047
347	.54517	.100	.941	1.70	.96	.041
348	.54544	.094	.941	1.60	.96	.035
349	.54936	.094	.944	1.67	.96	.038
350	.55418	.088	.944	1.57	.97	.032
351	.55564	.088	.946	1.65	.96	.035
352	.55631	.082	.946	1.54	.97	.029

353	.55793	.082	.949	1.62	.97	.031
354	.55993		.952			.031
355	.56283	.082	.954	1.71 1.81	.96	.034
356	56622	.082	.954		.96	
				1.92	.96	.039
357	.56861	.082	.960	2.05	.96	.042
358	.57039	.082	.962	2.19	.95	.045
359	.57127	.076	.965	2.19	.96	.042
360	.57299	.076	.968	2.38	.95	.044
361	.57520	.071	.968	2.19	.96	.038
362	.57631	.065	.971	2.19	.96	.035
363	.57962	.065	.973	2.41	.96	.038
364	.58715	.065	.976	2.68	.96	.041
365	.59219	.059	.976	2.44	.96	.035
366	.59715	.059	.981	3.13	.96	.040
367	.60161	.059	.984	3.66	.96	.043
368	.60700	.059	.987	4.39	.95	.045
369	.61769	.053	.987	3.95	.96	.040
370	.62452	.053	.989	4.94	.96	.042
371	.62616	.053	.992	6.58	.95	.045
372	.62680	.047	.992	5.85	.96	.039
373	.63290	.047	.995	8.78	.96	.042
374	.64024	.041	.995	7.68	.96	.036
375	.64543	.035	.995	6.58	.97	.030
376	.65529	.029	.995	5.49	.98	.024
377	.66904	.024	.995	4.39	.98	.018
378	.68278	.024	.997	8.78	.98	.021
379	.71413	.018	.997	6.58	.98	.015
380	.74919	.018	1.000	•		.018
381	.76250	.012	1.000		•	.012
382	.85844	.006	1.000			.006
383	1.00000	.000	1.000			.000

Appendix D: Prognostic Indexes for Model Predicting Injuries Defined by the Modified Installation Injury Index

Cut	Positive if	Sensitivity	Specificity	Positive	Negative	Youden's Index
Score	Probability of			Likelihood Ratio	Likelihood Ratio	
#	Outcome			1/7		_
	Greater Than or					
	Equal To					
1	.00000	1.000	.000			.000
2	.00000	1.000	.003			.003
3	.00000	1.000	.006			.006
4	.00000	1.000	.009			.009
5	.01041	1.000	.012			.012
6	.02209	1.000	.015			.015
7	.02585	1.000	.018		1 .	.018
8	.03216	1.000	.021			.021
9	.03688	1.000	.024			.024
10	.04769	1.000	.026			.026
11	.05869	1.000	.029			.029
12	.06092	1.000	.032			.032
13	.06369	1.000	.035			.035
14	.06900	1.000	.038			.038
15	.07416	1.000	.041		1	.041
16	.08134	1.000	.044			.044
17	.08793	1.000	.047			.047
18	.09308	.995	.047	1.04	.11	.042
19	.10857	.995	.050	1.05	.11	.045
20	.12216	.995	.053	1.05	.10	.048
21	.12815	.995	.056	1.05	.10	.051
22	.13259	.995	.059	1.06	.09	.053
23	.13747	.995	.062	1.06	.09	.056
24	.14202	.995	.065	1.06	.08	.059
25	.14260	.995	.068	1.07	.08	.062
26	.14350	.995	.071	1.07	.08	.065
27	.14469	.989	.071	1.06	.15	.060
28	.14760	.989	.074	1.07	.15	.063
29	.15067	.989	.076	1.07	.14	.066
30	.15210	.984	.076	1.07	.21	.060
31	.15344	.984	.079	1.07	.20	.063
32	.15438	.984	.082	1.07	.20	.066

33	.15567	.978	.082	1.07	.26	.061
34	.15740	.978	.085	1.07	.25	.064
35	.15934	.973	.085	1.06	.32	.058
36	.16085	.968	.085	1.06	.38	.053
37	.16156	.968	.088	1.06	.37	.056
38	.16201	.968	.091	1.06	.35	.059
39	.16299	.968	.094	1.07	.34	.062
40	.16430	.968	.100	1.08	.32	.068
41	.16509	.968	.103	1.08	.31	.071
42	.16708	.968	.106	1.08	.30	.074
43	.16908	.968	.109	1.09	.30	.077
44	.17091	.968	.112	1.09	.29	.080
45	.17280	.968	.115	1.09	.28	.082
46	.17383	.968	.118	1.10	.27	.085
47	.17479	.968	.121	1.10	.27	.088
48	.17529	.968	.124	1.10	.26	.091
49	.17661	.968	.126	1.11	.26	.094
50	.17839	.968	.129	1.11	.25	.097
51	.17917	.968	.132	1.12	.24	.100
52	.17960	.968	.138	1.12	.23	.106
53	.18027	.968	.141	1.13	.23	.109
54	.18161	.968	.144	1.13	.22	.112
55	.18286	.962	.144	1.12	.26	.106
56	.18360	.962	.147	1.13	.26	.109
57	.18488	.962	.150	1.13	.25	.112
58	.18646	.962	.153	1.14	.25	.115
59	.18755	.962	.156	1.14	.24	.118
60	.18781	.957	.159	1.14	.27	.116
61	.18847	.957	.162	1.14	.27	.119
62	.18914	.957	.165	1.15	.26	.122
63	.19003	.957	.171	1.15	.25	.128
64	.19196	.957	.174	1.16	.25	.131
65	.19307	.957	.176	1.16	.24	.133
66	.19398	.957	.185	1.17	.23	.142
67	.19493	.957	.188	1.18	.23	.145
68	.19540	.957	.191	1.18	.22	.148
69	.19647	.957	.194	1.19	.22	.151
70	.19758	.952	.194	1.18	.25	.146
71	.19848	.946	.197	1.18	.27	.143
72	.19905	.946	.200	1.18	.27	.146

73	.19928	.946	.203	1.19	.26	.149
74	.20010	.946	.209	1.20	.26	.155
75	.20089	.946	.212	1.20	.25	.158
76	.20111	.946	.215	1.20	.25	.161
77	.20130	.946	.218	1.21	.25	.164
78	.20141	.946	.221	1.21	.24	.167
79	.20288	.946	.224	1.22	.24	.170
80	.20470	.946	.226	1.22	.24	.173
81	.20526	.941	.226	1.22	.26	.167
82	.20683	.941	.229	1.22	.26	.170
83	.20871	.935	.232	1.22	.28	.168
84	.20934	.935	.235	1.22	.27	.171
85	.20954	.935	.238	1.23	.27	.174
86	.20986	.935	.241	1.23	.27	.177
87	.21169	.935	.247	1.24	.26	.183
88	.21347	.935	.250	1.25	.26	.185
89	.21376	.930	.250	1.24	.28	.180
90	.21437	.930	.253	1.25	.28	.183
91	.21616	.930	.256	1.25	.27	.186
92	.21761	.925	.256	1.24	.29	.181
93	.21907	.925	.259	1.25	.29	.184
94	.22071	.919	.262	1.25	.31	.181
95	.22260	.919	.265	1.25	.30	.184
96	.22443	.914	.265	1.24	.32	.179
97	.22588	.914	.268	1.25	.32	.182
98	.22714	.914	.271	1.25	.32	.185
99	.22840	.909	.271	1.25	.34	.179
100	.22967	.909	.274	1.25	.33	.182
101	.22997	.909	.279	1.26	.33	.188
102	.23033	.909	.282	1.27	.32	.191
103	.23068	.909	.285	1.27	.32	.194
104	.23108	.909	.288	1.28	.32	.197
105	.23149	.909	.291	1.28	.31	.200
106	.23206	.903	.291	1.27	.33	.194
107	.23292	.903	.294	1.28	.33	.197
108	.23380	.903	.297	1.28	.33	.200
109	.23438	.898	.297	1.28	.34	.195
110	.23502	.892	.297	1.27	.36	.190
111	.23557	.892	.300	1.27	.36	.192
112	.23581	.892	.303	1.28	.35	.195

113	.23742	.892	.306	1.29	.35	.198
114	.23923	.892	.309	1.29	.35	.201
115	.24001	.892	.312	1.30	.34	.204
116	.24123	.892	.315	1.30	.34	.207
117	.24211	.892	.318	1.31	.34	.210
118	.24247	.892	.321	1.31	.34	.213
119	.24291	.887	.324	1.31	.35	.211
120	.24316	.882	.324	1.30	.37	.205
121	.24333	.882	.326	1.31	.36	.208
122	.24386	.882	.329	» 1.31	.36	.211
123	.24432	.882	.332	1.32	.36	.214
124	.24449	.882	.335	1.33	.35	.217
125	.24528	.882	.338	1.33	.35	.220
126	.24632	.882	.341	1.34	.35	.223
127	.24686	.882	.344	1.34	.34	.226
128	.24715	.882	.347	1.35	.34	.229
129	.24785	.882	.350	1.36	.34	.232
130	.24848	.876	.353	1.35	.35	.229
131	.24965	.871	.353	1.35	.37	.224
132	.25112	.871	.356	1.35	.36	.227
133	.25193	.866	.356	1.34	.38	.221
134	.25262	.866	.359	1.35	.37	.224
135	.25469	.860	.359	1.34	.39	.219
136	.25660	.860	.362	1.35	.39	.222
137	.25697	.860	.365	1.35	.38	.225
138	.25752	.860	.368	1.36	.38	.228
139	.25861	.860	.371	1.37	.38	.231
140	.26029	.860	.374	1.37	.37	.234
141	.26141	.860	.376	1.38	.37	.237
142	.26179	.860	.379	1.39	.37	.240
143	.26210	.860	.382	1.39	.37	.243
144	.26232	.860	.385	1.40	.36	.246
145	.26257	.860	.388	1.41	.36	.248
146	.26295	.855	.388	1.40	.37	.243
147	.26325	.849	.388	1.39	.39	.238
148	.26353	.849	.394	1.40	.38	.244
149	.26377	.849	.397	1.41	.38	.247
150	.26430	.844	.397	1.40	.39	.241
151	.26490	.839	.397	1.39	.41	.236
152	.26526	.839	.400	1.40	.40	.239

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153	.26568	.839	.403	1.40	.40	.242
154	.26600	.839	.406	1.41	.40	.245
155	.26641	.839	.409	1.42	.39	.248
156	.26805	.839	.412	1.43	.39	.250
157	.26952	.833	.412	1.42	.40	.245
158	.27003	.833	.415	1.42	.40	.248
159	.27046	.833	.418	1.43	.40	.251
160	.27103	.833	.421	1.44	.40	.254
161	.27183	.833	.424	1.45	.39	.257
162	.27221	.828	.424	1.44	.41	.251
163	.27278	.823	.424	1.43	.42	.246
164	.27334	.817	.424	1.42	.43	.241
165	.27374	.812	.424	1.41	.44	.235
166	.27449	.812	.426	1.42	.44	.238
167	.27670	.806	.426	1.41	.45	.233
168	.27871	.806	.429	1.41	.45	.236
169	.27951	.806	.432	1.42	.45	.239
170	.28008	⊴.801	.432	1.41	.46	.233
171	.28053	.801	.435	1.42	.46	.236
172	.28180	.796	.435	1.41	.47	.231
173	.28354	.796	.438	1.42	.47	.234
174	.28460	.790	.438	1.41	.48	.229
175	.28536	.785	.441	1.40	.49	.226
176	.28612	.785	.444	1.41	.48	.229
177	.28641	.785	.447	1.42	.48	.232
178	.28707	.785	.450	1.43	.48	.235
179	.28825	.780	.450	1.42	.49	.230
180	.28929	.780	.456	1.43	.48	.235
181	.28970	.780	.459	1.44	.48	.238
182	.28999	.774	.459	1.43	.49	.233
183	.29146	.774	.462	1.44	.49	.236
184	.29264	.769	.462	1.43	.50	.231
185	.29314	.769	.465	1.44	.50	.234
186	.29368	.769	.468	1.44	.49	.236
187	.29483	.769	.471	1.45	.49	.239
188	.29594	.763	.471	1.44	.50	.234
189	.29642	.763	.474	1.45	.50	.237
190	.29716	.763	.476	1.46	.50	.240
191	.29895	.763	.479	1.47	.49	.243
192	.30078	.763	.482	1.47	.49	.246
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193	.30125	.763	.485	1.48	.49	.249
194	.30152	.763	.488	1.49	.48	.252
195	.30164	.763	.494	1.51	.48	.258
196	.30197	.763	.497	1.52	.48	.260
197	.30246	.763	.500	1.53	.47	.263
198	.30273	.758	.500	1.52	.48	.258
199	.30375	.758	.503	1.53	.48	.261
200	.30558	.758	.506	1.53	.48	.264
201	.30665	.758	.509	1.54	.48	.267
202	.30725	.747	.509	1.52	.50	.256
203	.30770	.747	.512	1.53	.49	.259
204	.30779	.742	.512	1.52	.50	.254
205	.30813	.737	.512	1.51	.51	.248
206	.31019	.737	.515	1.52	.51	.251
207	.31200	.737	.518	1.53	.51	.254
208	.31233	.737	.521	1.54	.51	.257
209	.31295	.737	.524	1.55	.50	.260
210	.31349	.737	.526	1.56	.50	.263
211	.31427	.737	.529	1.57	.50	.266
212	.31480	.737	.532	1.58	.49	.269
213	.31495	.737	.535	1.59	.49	.272
214	.31540	.731	.535	1.57	.50	.266
215	.31602	.731	.538	1.58	.50	.269
216	.31652	.731	.541	1.59	.50	.272
217	.31692	.731	.544	1.60	.49	.275
218	.31735	.731	.547	1.61	.49	.278
219	.31776	.726	.550	1.61	.50	.276
220	.31889	.720	.550	1.60	.51	.270
221	.32139	.720	.553	1.61	.51	.273
222	.32307	.710	.553	1.59	.53	.263
223	.32385	.710	.556	1.60	.52	.266
224	.32496	.704	.556	1.59	.53	.260
225	.32547	.699	.556	1.57	.54	.255
226	.32566	.694	.556	1.56	.55	.249
227	.32606	.694	.559	1.57	.55	.252
228	.32633	.694	.562	1.58	.55	.255
229	.32697	.694	.571	1.62	.54	.264
230	.32763	.694	.574	1.63	.53	.267
231	.32796	.694	.576	1.64	.53	.270
232	.32844	.694	.579	1.65	.53	.273

						1.1
233	.32951	.688	.579	1.64	.54	.268
234	.33046	.683	.579	1.62	.55	.262
235	.33098	.683	.582	1.63	.54	.265
236	.33173	.683	.585	1.65	.54	.268
237	.33203	.683	.588	1.66	.54	.271
238	.33298	.683	.591	1.67	.54	.274
239	.33432	.683	.594	1.68	.53	.277
240	.33472	.677	.594	1.67	.54	.272
241	.33530	.677	.597	1.68	.54	.274
242	.33587	.677	.600	1.69	.54	.277
243	.33596	.672	.600	1.68	.55	.272
244	.33658	.672	.603	1.69	.54	.275
245	.33714	.667	.603	1.68	.55	.270
246	.33827	.667	.609	1.70	.55	.275
247	.33993	.667	.612	1.72	.54	.278
248	.34092	.661	.612	1.70	.55	.273
249	.34248	.661	.615	1.72	.55	.276
250	.34364	.661	.618	1.73	.55	.279
251	.34426	.656	.618	1.72	.56	.274
252	.34632	.651	.618	1.70	.57	.268
253	.34796	.651	.621	1.71	.56	.271
254	.34815	.645	.624	1.71	.57	.269
255	.34847	.645	.629	1.74	.56	.275
256	.34913	.640	.629	1.73	.57	.269
257	.35042	.640	.632	1.74	.57	.272
258	.35234	.640	.635	1.75	.57	.275
259	.35349	.640	.638	1.77	.56	.278
260	.35383	.634	.638	1.75	.57	.273
261	.35417	.634	.641	1.77	.57	.276
262	.35451	.634	.644	1.78	.57	.279
263	.35501	.629	.644	1.77	.58	.273
264	.35596	.624	.647	1.77	.58	.271
265	.35746	.624	.650	1.78	.58	.274
266	.35842	.618	.650	1.77	.59	.268
267	.35890	.613	.650	1.75	.60	.263
268	.35946	.613	.653	1.77	.59	.266
269	.35978	.613	.656	1.78	.59	.269
270	.36022	.613	.659	1.80	.59	.272
271	.36062	.613	.662	1.81	.58	.275
272	.36097	.608	.662	1.80	.59	.269

273	.36138	.608	.668	- 1.83	.59	.275
274	.36159	.608	.671	1.84	.59	.278
275	.36193	.608	.674	1.86	.58	.281
276	.36243	.608	.676	1.88	.58	.284
277	.36323	.602	.676	1.86	.59	.279
278	.36400	.597	.676	1.84	.60	.273
279	.36424	.591	.676	1.83	.60	.268
280	.36476	.591	.679	1.84	.60	.271
281	.36593	.591	.682	1.86	.60	.274
282	.36693	.586	.682	1.84	.61	.268
283	.36752	.586	.685	1.86	.60	.271
284	.36786	.581	.685	1.85	.61	.266
285	.36836	.581	.688	1.86	.61	.269
286	.36990	.581	.691	1.88	.61	.272
287	.37112	.575	.691	1.86	.61	.266
288	.37152	.575	.694	1.88	.61	.269
289	.37182	.575	.697	1.90	.61	.272
290	.37343	.570	.703	1.92	.61	.273
291	.37579	.565	.703	1.90	.62	.267
292	.37726	.565	.706	1.92	.62	.270
293	.37944	.565	.709	1.94	.61	.273
294	.38113	.559	.709	1.92	.62	.268
295	.38135	.554	.709	1.90	.63	.263
296	.38206	.548	.709	1.88	.64	.257
297	.38347	.543	.709	1.86	.64	.252
298	.38429	.543	.712	1.88	.64	.255
299	.38488	.538	.712	1.87	.65	.249
300	.38538	.538	.715	1.88	.65	.252
301	.38572	.532	.715	1.87	.65	.247
302	.38609	.532	.718	1.89	.65	.250
303	.38643	.527	.718	1.87	.66	.245
304	.38706	.522	.718	1.85	.67	.239
305	.38777	.522	.721	1.87	.66	.242
306	.38955	.522	.724	1.89	.66	.245
307	.39108	.522	.726	1.91	.66	.248
308	.39240	.516	.726	1.89	.67	.243
309	.39390	.516	.729	1.91	.66	.246
310	.39426	.516	.732	1.93	.66	.248
311	.39430	.511	.732	1.91	.67	.243
312	.39462	.505	.732	1.89	.68	.238

313	.39492	.505	.735	1.91	.67	.241
314	.39496	.505	.738	1.93	.67	.244
315	.39547	.505	.741	1.95	.67	.247
316	.39619	.505	.744	1.98	.66	.249
317	.39654	.505	.747	2.00	.66	.252
318	.39683	.505	.750	2.02	.66	.255
319	.39801	.505	.753	2.05	.66	.258
320	.39921	.500	.753	2.02	.66	.253
321	.39957	.500	.756	2.05	.66	.256
322	.40068	.500	.759	2.07	.66	.259
323	.40205	.495	.759	2.05	.67	.253
324	.40249	.489	.759	2.03	.67	.248
325	.40299	.489	.762	2.05	.67	.251
326	.40383	.489	.765	2.08	.67	.254
327	.40440	.484	.765	2.06	.67	.249
328	.40475	.484	.768	2.08	.67	.252
329	.40625	.484	.771	2.11	.67	.254
330	.40866	.478	.771	2.09	.68	.249
331	.40970	.473	.771	2.06	.68	.244
332	.41025	.473	.774	2.09	.68	.247
333	.41082	.473	.776	2.12	.68	.250
334	.41152	.473	.779	2.14	.68	.253
335	.41253	.473	.782	2.17	.67	.255
336	.41357	.468	.782	2.15	.68	.250
337	.41477	.462	.788	2.18	.68	.251
338	.41601	.457	.788	2.16	.69	.245
339	.41693	.457	.791	2.19	.69	.248
340	.41730	.452	.794	2.19	.69	.246
341	.41759	.446	.794	2.17	.70	.240
342	.41915	.441	.794	2.14	.70	.235
343	.42074	.435	.794	2.12	.71	.230
344	.42132	.430	.794	2.09	.72	.224
345	.42220	.430	.797	2.12	.71	.227
346	.42279	.430	.800	2.15	.71	.230
347	.42383	.430	.803	2.18	.71	.233
348	.42499	.430	.806	2.22	.71	.236
349	.42644	.430	.809	2.25	.70	.239
350	.42882	.430	.812	2.28	.70	.242
351	.43046	.425	.812	2.26	.71	.236
352	.43116	.425	.815	2.29	.71	.239

353	.43159	.419	.815	2.26	.71	.234
354	.43280	.419	.818	2.30	.71	.237
355	.43428	.419	.821	2.34	.71	.240
356	.43534	.419	.824	2.38	., . 3 .71	.243
357	.43655	.419	.826	2.42	.70	.246
358	.43796	.419	.829	2.46	.70	.249
359	.43986	.419	.832	2.50	.70	.252
360	.44110	.414	.832	2.47	.70	.246
361	.44197	.414	.835	2.47	.70	.249
362	.44339	.409	.835	2.48		.249
363	.44426	.409	.838	2.46	.71 .71	
364	.44444	.403	.838	2.53		.247
365	.44455	.403	.841		.71	.241
366	.44498	.398	.841	2.54	.71	.244
367	.44634	.392		2.50 2.47	.72	.239
368	.44786		.841		.72	.234
369	.44857	.392	.844	2.52	.72	.237
370	.44913	.387	.844	2.48	.73	.231
371	.45051	.387	.847	2.53	.72	.234
	.45051	.387	.850	2.58	.72	.237
372 373	.45176	.382	.850	2.54	.73	.232
374	.45299	.382	.853	2.60	.72	.235
375	.45494	.376 .371	.853	2.56	.73	.229
376	.45494	.366	.853	2.52	.74	.224
377	.45904	.366	.853	2.49	.74	.219
378	.46082	.366	.856 .859	2.54	.74	.221
379	.46172	.366	.862	2.59	.74	.224
				2.64	.74	.227
380	.46362 .46532	.360 .355	.862 .862	2.61 2.57	.74 .75	.222 .217
382	.46648	.355	.865	2.62	.75	
383	.46766	.355	.868	2.68		.220
384	.46866	.355	.871		.74	.222
385	.46952	.349		2.74	.74	.225
386	.47170	.349	.871	2.70	.75	.220
387			.874	2.76	.74	.223
	.47495 .47704	.344	.874	2.72	.75	.218
388		.339	.874	2.68	.76	.212
389	.47831	.339	.876	2.74	.75	.215
390	.48048	.333	.876	2.70	.76	.210
391	.48279	.333	.879	2.76	.76	.213
392	.48475	.333	.882	2.83	.76	.216

393	.48676	.333	.885	2.91	.75	.219
394	.48802	.333	.888	2.98	.75	.222
395	.48887	.328	.888	2.93	.76	.216
396	.48914	.328	.891	3.01	.75	.219
397	.49005	.328	.894	3.10	.75	.222
398	.49190	.323	.894	3.05	.76	.217
399	.49328	.317	.894	3.00	.76	.211
400	.49370	.317	.897	3.08	.76	.214
401	.49395	.312	.897	3.03	.77	.209
402	.49434	.306	.897	2.98	.77	.204
403	.49562	.306	.900	3.06	.77	.206
404	.49698	.301	.900	3.01	.78	.201
405	.49745	.296	.900	2.96	.78	.196
406	.49765	.296	.903	3.05	.78	.199
407	.49774	.296	.906	3.14	.78	.202
408	.49886	.290	.906	3.08	.78	.196
409	.50075	.290	.909	3.18	.78	.199
410	.50198	.285	.909	3.13	.79	.194
411	.50292	.285	.912	3.23	.78	.197
412	.50412	.285	.915	3.34	.78	.200
413	.50503	.285	.918	3.46	.78	.203
414	.50881	.285	.921	3.59	.78	.206
415	.51318	.280	.921	3.52	.78	.200
416	.51497	.274	.921	3.45	.79	.195
417	.51659	.263	.921	3.32	.80	.184
418	.51747	.263	.924	3.44	.80	.187
419	.51803	.258	.924	3.37	.80	.182
420	.51892	.253	.924	3.30	.81	.176
421	.52028	.247	.924	3.23	.82	.171
422	.52277	.242	.924	3.16	.82	.165
423	.52785	.237	.924	3.09	.83	.160
424	.53234	.231	.924	3.02	.83	.155
425	.53359	.226	.924	2.95	.84	.149
426	.53435	.226	.926	3.07	.84	.152
427	.53558	.226	.929	3.20	.83	.155
428	.53659	.220	.929	3.12	.84	.150
429	.53715	.215	.929	3.05	.84	.144
430	.53825	.210	.929	2.97	.85	.139
431	.53929	.210	.932	3.10	.85	.142
432	.53992	.210	.935	3.24	.84	.145

433	.54720	.204	.935	3.16	.85	.140
434	.55578	.204	.938	3.31	.85	.143
435	.55778	.204	.941	3.47	.85	.145
436	.56291	.199	.941	3.38	.85	.140
437	.56834	.194	.941	3.29	.86	.135
438	.56886	.188	.941	3.20	.86	.129
439	.57079	.188	.944	3.37	.86	.132
440	.57335	.183	.944	3.27	.87	.127
441	.57788	.177	.944	3.17	.87	.122
442	.58302	.172	.944	3.08	.88	.116
443	.58537	.167	.944	2.98	.88	.111
444	.58739	.161	.944	2.89	.89	.105
445	.59025	.156	.944	2.79	.89	.100
446	.59281	.151	.944	2.69	.90	.095
447	.59517	.145	.944	2.60	.91	.089
448	.59751	.140	.944	2.50	.91	.084
449	.59839	.134	.944	2.41	.92	.079
450	.59873	.129	.944	2.31	.92	.073
451	.59915	.124	.944	2.21	.93	.068
452	.60087	.118	.944	2.12	.93	.062
453	.60523	.113	.944	2.02	.94	.057
454	.60846	.113	.947	2.13	.94	.060
455	.60914	.108	.947	2.03	.94	.055
456	.61156	.108	.950	2.15	.94	.058
457	.61555	.108	.953	2.28	.94	.060
458	.61807	.108	.956	2.44	.93	.063
459	.62145	.108	.959	2.61	.93	.066
460	.62514	.108	.962	2.81	.93	.069
461	.62751	.102	.962	2.67	.93	.064
462	.63201	.102	.965	2.89	.93	.067
463	.63508	.102	.968	3.16	.93	.070
464	.63527	.097	.968	2.99	.93	.064
465	.63802	.086	.968	2.66	.94	.054
466	.64132	.086	.971	2.92	.94	.057
467	.64263	.086	.974	3.25	.94	.060
468	.64677	.086	.976	3.66	.94	.062
469	.65265	.086	.979	4.18	.93	.065
470	.65749	.081	.979	3.92	.94	.060
471	.66181	.075	.979	3.66	.94	.055
472	.66580	.070	.979	3.39	.95	.049

					1	
473	.67052	.065	.979	3.13	.96	.044
474	.67744	.065	.982	3.66	.95	.047
475	.68359	.065	.985	4.39	.95	.050
476	.68651	.059	.985	4.02	.95	.044
477	.68928	.059	.991	6.70	.95	.050
478	.69199	.054	.991	6.09	.95	.045
479	.69744	.048	.991	5.48	.96	.040
480	.70202	.048	.994	8.23	.96	.043
481	.70396	.048	.997	16.45	.95	.045
482	.71017	.043	.997	14.62	.96	.040
483	.74298	.038	.997	12.80	.97	.035
484	.77738	.032	.997	10.97	.97	.029
485	.78670	.027	.997	9.14	.98	.024
486	.79399	.022	.997	7.31	.98	.019
487	.79935	.016	.997	5.48	.99	.013
488	.84196	.016	1.000			.016
489	.88560	.011	1.000		* · ·	.011
490	.94038	.005	1.000		ా,	.005
491	1.00000	.000	1.000			.000

Appendix E: Prognostic Indexes for Model Predicting Injuries Defined by the Overuse Injury Index

Cut	Positive if	Sensitivity	Specificity	Positive	Negative	Youden's index
Score	Probability of	8		Likelihood Ratio	Likelihood Ratio	
#	Outcome					
	Greater Than or			1,		
1.	Equal To					
1	.00000	1.000	.000	- " .		.000
2	.10172	.992	.000			008
3	.10504	.992	.003	.99	2.89	005
4	.10716	.992	.006	1.00	1.45	003
5	.10924	.992	.009	1.00	.96	.000
6	.10987	.992	.012	1.00	.72	.003
7	.11073	.992	.015	1.01	.58	.006
8	.11181	.992	.017	1.01	.48	.009
9	.11305	.992	.020	1.01	.41	.012
10	.11532	.992	.023	1.02	.36	.015
11	.11709	.992	.026	1.02	.32	.018
12	.11737	.992	.029	1.02	.29	.021
13	.11771	.992	.032	1.02	.26	.024
14	.11892	.992	.035	1.03	.24	.026
15	.12118	.992	.038	1.03	.22	.029
16	.12241	.992	.041	1.03	.21	.032
17	.12346	.992	.047	1.04	.18	.038
18	.12512	.992	.049	1.04	.17	.041
19	.12611	.992	.052	1.05	.16	.044
20	.12660	.992	.055	1.05	.15	.047
21	.12687	.992	.058	1.05	.14	.050
22	.12743	.992	.061	1.06	.14	.053
23	.12833	.992	.064	1.06	.13	.056
24	.12883	.992	.067	1.06	.13	.058
25	.12914	.983	.067	1.05	.25	.050
26	.12947	.975	.067	1.04	.38	.042
27	.12970	.975	.070	1.05	.36	.045
28	.13040	.975	.073	1.05	.35	.047
29	.13116	.975	.076	1.05	.33	.050
30	.13269	.975	.078	1.06	.32	.053
31	.13421	.975	.081	1.06	.31	.056
32	.13451	.975	.084	1.06	.30	.059

33	.13475	.975	.087	1.07	.29	.062
34	.13492	.975	.090	1.07	.28	.065
35	.13547	.966	.090	1.06	.37	.057
36	.13627	.966	.093	1.07	.36	.059
37	.13703	.966	.096	1.07	.35	.062
38	.13807	.966	.090	1.07	.34	.065
	iii		.102	1.07		.068
39	.13924	.966 .966		1.08	.33	.071
40	.14006 .14080		.105	1.08		
41		.966	.108		.31	.074
42	.14186	.958	.108	1.07	.39	.066
43	.14244	.958	.110	1.08	.38	.068
44	.14252	.958	.113	1.08	.37	.071
45	.14263	.958	.116	1.08	.36	.074
46	.14280	.958	.119	1.09	.35	.077
47	.14298	.958	.122	1.09	.34	.080
48	.14401	.958	.128	1.10	.33	.086
49	.14508	.958	.131	1.10	.32	.089
50	.14530	.958	.134	1.11	.31	.092
51	.14593	.958	.140	1.11	.30	.098
52	.14707	.958	.142	1.12	.29	.100
53	.14794	.950	.142	1.11	.35	.092
54	.14823	.941	.142	1.10	.41	.084
55	.14854	.941	.145	1.10	.40	.087
56	.14913	.941	.148	1.10	.40	.089
57	.15000	.941	.151	1.11	.39	.092
58	.15073	.941	.154	1.11	.38	.095
59	.15099	.941	.157	1.12	.37	.098
60	.15108	.941	.160	1.12	.37	.101
61	.15134	.941	.163	1.12	.36	.104
62	.15167	.941	.166	1.13	.36	.107
63	.15180	.941	.172	1.14	.34	.113
64	.15181	.941	.174	1.14	.34	.116
65	.15212	.941	.177	1.14	.33	.119
66	.15256	.941	.180	1.15	.33	.121
67	.15281	.941	.183	1.15	.32	.124
68	.15325	.941	.186	1.16	.32	.127
69	.15405	.941	.189	1.16	.31	.130
70	.15547	.941	.192	1.16	.31	.133
71	.15699	.933	.192	1.15	.35	.125
72	.15762	.933	.198	1.16	.34	.130

1 1	45700			ا د د		400
73	.15766	.933	.201	1.17	.34	.133
74	.15784	.924	.201	1.16	.38	.125
75	.15807	.924	.203	1.16	.37	.128
76	.15820	.916	.203	1.15	.41	.119
77	.15850	.916	· .206	1.15	.41	.122
78	.15878	.916	.209	1.16	.40	.125
79	.15906	.916	.212	1.16	.40	.128
80	.15933	.916	.215	1.17	.39	.131
81	.15945	.916	.218	1.17	.39	.134
82	.15957	.916	.221	1.18	.38	.137
83	.15972	.916	.224	1.18	.38	.140
84	.15988	.916	.227	1.18	.37	.143
85	.15998	.916	.230	1.19	.37	.146
86	.16033	.916	.233	1.19	.36	.149
87	.16072	.916	.235	1.20	.36	.151
88	.16098	.916	.238	1.20	.35	.154
89	.16122	.916	.241	1.21	.35	.157
90	.16160	.916	.244	1.21	.34	.160
91	.16276	.916	.247	1.22	.34	.163
92	.16369	.916	.250	1.22	.34	.166
93	.16409	.916	.253	1.23	.33	.169
94	.16473	.916	.256	1.23	.33	.172
95	.16530	.916	.259	1.24	.32	.175
96	.16587	.916	.262	1.24	.32	.178
97	.16648	.908	.262	1.23	.35	.169
98	.16676	.908	.265	1.23	.35	.172
99	.16705	.899	.267	1.23	.38	.167
100	.16771	.899	.270	1.23	.37	.170
101	.16809	.899	.273	1.24	.37	.172
102	.16813	.899	.276	1.24	.37	.175
103	.16826	.899	.279	1.25	.36	.178
104	.16850	.899	.282	1.25	.36	.181
105	.16894	.899	.285	1.26	.35	.184
106	.16955	.891	.288	1.25	.38	.179
107	.17053	.891	.291	1.26	.38	.181
108	.17122	.891	.294	1.26	.37	.184
109	.17210	.891	.297	1.27	.37	.187
110	.17302	.891	.299	1.27	.36	.190
111	.17312	.891	.302	1.28	.36	.193
112	.17379	l .		1.28		
		,		F 9		

113	.17448	.891	.308	1.29	.35	.199
114	.17457	.891	.311	1.29	.35	.202
115	.17511	.891	.314	1.30	.35	.205
116	.17564	.891	.317	1.30	.34	.208
117	.17569	.891	.323	1.32	.34	.213
118	.17574	.891	.326	1.32	.34	.216
119	.17604	.882	.326	1.31	.36	.208
120	.17676	.882	.328	1.31	.36	.208
121	.17724	.882	.331			
	- 2			1.32	.36	.214
122	.17752	.882	.334	1.33	.35	.217
123	.17816	.882	.337	1.33	.35	.220
124	.17889	.882	.340	1.34	.35	.222
125	.17949	.874	.340	1.32	.37	.214
126	.17979	.874	.346	1.34	.36	.220
127	.18005	.874	.349	1.34	.36	.223
128	.18040	.874	.352	1.35	.36	.226
129	.18080	.866	.352	1.34	.38	.217
130	.18136	.866	.355	1.34	.38	.220
131	.18184	.866	.358	1.35	.38	.223
132	.18229	.866	.360	1.35	.37	.226
133	.18264	.866	.363	1.36	.37	.229
134	.18285	.857	.363	1.35	.39	.221
135	.18337	.857	.366	1.35	.39	.223
136	.18388	.857	.369	1.36	.39	.226
137	.18459	.849	.369	1.35	.41	.218
138	.18546	.849	.372	1.35	.41	.221
139	.18576	.849	.375	1.36	.40	.224
140	.18658	.849	.378	1.36	.40	.227
141	.18751	.849	.381	1.37	.40	.230
142	.18772	.849	.384	1.38	.39	.232
143	.18792	.840	.384	1.36	.42	.224
144	.18833	.840	.387	1.37	.41	.227
145	.18859	.840	.390	1.38	.41	.230
146	.18879	.840	.392	1.38	.41	.233
147	.18936	.840	.395	1.39	.40	.236
148	.19009	.840	.398	1.40	.40	.239
149	.19077	.840	.401	1.40	.40	.241
150	.19114	.840	.404	1.41	.40	.244
151	.19123	.840	.407	1.42	.39	.247
152	.19141	.840	.410	1.42	.39	.250

153	.19165	.840	.413	1.43	.39	.253
154	.19180	.840	.416	1.44	.38	.256
155	.19182	.840	.419	1.45	.38	.259
156	.19229	.832	.419	1.43	.40	.251
157	.19308	.832	.422	1.44	.40	.253
158	.19377	.832	.424	1.45	.40	.256
159	.19424	.824	.424	1.43	.42	.248
160	.19434	.824	.427	1.44	.41	.251
161	.19450	.824	.430	1.45	.41	.254
162	.19475	.815	.430	1.43	.43	.245
163	.19519	.815	.433	1.44	.43	.248
164	.19613	.815	.436	1.45	.42	.251
165	.19674	.815	.439	1.45	.42	.254
166	.19700	.815	.442	1.46	.42	.257
167	.19745	.815	.445	1.47	.42	.260
168	.19794	.807	.445	1.45	.43	.251
169	.19836	.798	.445	1.44	.45	.243
170	.19890	.798	.448	1.45	.45	.246
171	.19953	.798	.451	1.45	.45	.249
172	.19980	.798	.453	1.46	.44	.252
173	.19987	.798	.456	1.47	.44	.255
174	.20035	.790	.456	1.45	.46	.246
175	.20094	.782	.456	1.44	.48	.238
176	.20122	.782	.459	1.45	.48	.241
177	.20161	.773	.459	1.43	.49	.232
178	.20194	.773	.462	1.44	.49	.235
179	.20248	.765	.462	1.42	.51	.227
180	.20312	.765	.465	1.43	.51	.230
181	.20338	.765	.468	1.44	.50	.233
182	.20378	.756	.468	1.42	.52	.224
183	.20408	.756	.471	1.43	.52	.227
184	.20468	.756	.474	1.44	.51	.230
185	.20545	.756	.477	1.45	.51	.233
186	.20596	.756	.480	1.45	.51	.236
187	.20635	.756	.483	1.46	.51	.239
188	.20645	.756	.485	1.47	.50	.242
189	.20695	.748	.485	1.45	.52	.233
190	.20751	.748	.488	1.46	.52	.236
191	.20768	.739	.488	1.45	.53	.228
192	.20782	.739	.491	1.45	.53	.231

193	.20853	.739	.494	1.46	.53	.234
194	.20921	.739	.497	1.47	.52	.237
195	.20971	.739	.500	1.48	.52	.239
196	.21016	.739	.503	1.49	.52	.242
197	.21029	.731	.503	1.47	.53	.234
198	.21056	.731	.506	1.48	.53	.237
199	.21077	.731	.509	1.49	.53	.240
200	.21085	.731	.512	1.50	.53	.243
201	.21098	.731	.515	1.51	.52	.246
202	.21177	.731	.517	1.52	.52	.249
203	.21325	.731	.520	1.52	.52	.251
204	.21421	.731	.523	1.53	.51	.254
205	.21442	.731	.526	1.54	.51	.257
206	.21447	.731	.529	1.55	.51	.260
207	.21489	.731	.535	1.57	.50	.266
208	.21535	.731	.538	1.58	.50	.269
209	.21567	.731	.541	1.59	.50	.272
210	.21648	.723	.541	1.57	.51	.263
211	.21706	.714	.541	1.56	.53	.255
212	.21718	.714	.544	1.57	.53	.258
213	.21750	.714	.547	1.58	.52	.261
214	.21788	.714	.549	1.59	.52	.264
215	.21817	.714	.552	1.60	.52	.267
216	.21847	.706	.552	1.58	.53	.258
217	.21860	.706	.555	1.59	.53	.261
218	.21883	.697	.555	1.57	.54	.253
219	.21922	.689	.555	1.55	.56	.244
220	.21963	.689	.558	1.56	.56	.247
221	.22006	.689	.561	1.57	.55	.250
222	.22066	.689	.564	1.58	.55	.253
223	.22170	.689	.567	1.59	.55	.256
224	.22264	.689	.570	1.60	.55	.259
225	.22347	.689	.573	1.61	.54	.262
226	.22405	.689	.576	1.62	.54	.265
227	.22441	.689	.578	1.63	.54	.268
228	.22474	.681	.578	1.61	.55	.259
229	.22488	.681	.581	1.63	.55	.262
230	.22610	.672	.581	1.61	.56	.254
231	.22755	.672	.584	1.62	.56	.257
232	.22796	.672	.590	1.64	.56	.262

233	.22891	.664	.590	1.62	.57	.254
234	.23002	.655	.593	1.61	.58	.248
235	.23052	.655	.596	1.62	.58	.251
236	.23091	.647	.596	1.60	.59	.243
237	.23135	.647	.599	1.61	.59	.246
238	.23176	.647	.602	1.62	.59	.249
239	.23220	.647	.605	1.64	.58	.252
240	.23264	.639	.605	1.62	.60	.243
241	.23353	.639	.608	1.63	.59	.246
242	.23486	.639	.610	1.64	.59	.249
243	.23544	.639	.613	1.65	.59	.252
244	.23574	.639	.616	1.66	.59	.255
245	.23614	.639	.619	1.68	.58	.258
246	.23647	.639	.622	1.69	.58	.261
247	.23695	.630	.622	1.67	.59	.252
248	.23747	.622	.622	1.65	.61	.244
249	.23767	.622	.625	1.66	.61	.247
250	.23797	.622	.628	1.67	.60	.250
251	.23875	.622	.634	1.70	.60	.256
252	.23938	.613	.634	1.67	.61	.247
253	.23972	.613	.637	1.69	.61	.250
254	.23997	.605	.637	1.67	.62	.242
255	.24021	.605	.640	1.68	.62	.245
256	.24105	.597	.640	1.66	.63	.236
257	.24253	.588	.640	1.63	.64	.228
258	.24367	.580	.640	1.61	.66	.219
259	.24418	.571	.640	1.59	.67	.211
260	.24472	.571	.642	1.60	.67	.214
261	.24586	.571	.645	1.61	.66	.217
262	.24749	.563	.645	1.59	.68	.208
263	.24847	.563	.648	1.60	.67	.211
264	.24894	.563	.651	1.61	.67	.214
265	.24934	.555	.651	1.59	.68	.206
266	.24972	.546	.651	1.57	.70	.197
267	.25011	.538	.651	1.54	.71	.189
268	.25038	.538	.654	1.55	.71	.192
269	.25063	.538	.657	1.57	.70	.195
270	.25086	.538	.660	1.58	.70	.198
271	.25160	.538	.663	1.59	.70	.201
272	.25274	.529	.663	1.57	.71	.192

274 .25597 .529 .669 1.60 .70 .15 275 .25624 .521 .669 1.57 .72 .18 276 .25662 .521 .672 1.59 .71 .13 277 .25700 .521 .674 1.60 .71 .13 278 .25772 .521 .677 1.61 .71 .11 279 .25938 .513 .677 1.59 .72 .11 280 .26168 .513 .680 1.60 .72 .11 281 .26326 .513 .683 1.62 .71 .11 281 .26326 .513 .683 1.62 .71 .11 282 .26366 .513 .683 1.62 .71 .21 283 .26458 .513 .699 1.66 .70 .22 284 .26679 .513 .692 1.66 .70 <td< th=""><th>273</th><th>.25453</th><th>.529</th><th>.666</th><th>1.58</th><th>1</th><th>71 .195</th><th>, </th></td<>	273	.25453	.529	.666	1.58	1	71 .195	,
275 .25624 .521 .669 1.57 .72 .15 276 .25662 .521 .672 1.59 .71 .18 277 .25700 .521 .674 1.60 .71 .13 278 .25772 .521 .677 1.61 .71 .13 279 .25938 .513 .677 1.59 .72 .11 280 .26168 .513 .680 1.60 .72 .11 281 .26366 .513 .680 1.60 .72 .11 282 .26366 .513 .686 1.63 .71 .21 283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .698 1.70 .70 .22 287 .26917 .513 .698 1.70 .70 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></td<>								1
276 .25662 .521 .672 1.59 .71 .15 277 .25700 .521 .674 1.60 .71 .15 278 .25772 .521 .677 1.61 .71 .15 279 .25938 .513 .677 1.59 .72 .11 280 .26168 .513 .680 1.60 .72 .11 281 .26326 .513 .680 1.60 .72 .11 282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .21 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
277 .25700 .521 .674 1.60 .71 .18 278 .25772 .521 .677 1.61 .71 .18 279 .25938 .513 .677 1.59 .72 .18 280 .26168 .513 .680 1.60 .72 .18 281 .26326 .513 .683 1.62 .71 .11 282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .698 1.70 .70 .22 288 .26997 .504 .701 1.68 .71 <td< td=""><td>1 </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	1							
278 .25772 .521 .677 1.61 .71 .15 279 .25938 .513 .677 1.59 .72 .15 280 .26168 .513 .680 1.60 .72 .15 281 .26326 .513 .683 1.62 .71 .11 282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 .22 288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 <td< td=""><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></td<>		1						
279 .25938 .513 .677 1.59 .72 .11 280 .26168 .513 .680 1.60 .72 .11 281 .26326 .513 .683 1.62 .71 .11 282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 .22 288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 .22 290 .27187 .504 .706 1.72 .70 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td></td<>								-
280 .26168 .513 .680 1.60 .72 .11 281 .26326 .513 .683 1.62 .71 .11 282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 .22 288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 .22 291 .27259 .496 .706 1.69 .71 .22 292 .27296 .496 .709 1.71 .71 <td< td=""><td></td><td></td><td></td><td>200</td><td></td><td></td><td></td><td></td></td<>				200				
281 .26326 .513 .683 1.62 .71 .11 282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 .2 288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 .22 290 .27187 .504 .706 1.72 .70 .22 291 .27259 .496 .706 1.69 .71 .22 292 .27296 .496 .709 1.71 .71								
282 .26366 .513 .686 1.63 .71 .11 283 .26458 .513 .689 1.65 .71 .21 284 .26679 .513 .692 1.66 .70 .21 285 .26827 .513 .695 1.68 .70 .21 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 .22 288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 .22 290 .27187 .504 .706 1.72 .70 .22 291 .27259 .496 .706 1.69 .71 .22 292 .27296 .496 .709 1.71 .71 .22 293 .27339 .496 .715 1.74 .71 <td< td=""><td></td><td></td><td> </td><td></td><td></td><td></td><td></td><td>-1</td></td<>								-1
283 .26458 .513 .689 1.65 .71 .22 284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .22 287 .26917 .513 .701 1.71 .70 .22 288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 .22 290 .27187 .504 .706 1.72 .70 .22 291 .27259 .496 .706 1.69 .71 .22 292 .27296 .496 .709 1.71 .71 .22 293 .27339 .496 .715 1.74 .71 .22 294 .27355 .487 .715 1.71 .72 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>- 1</td></td<>								- 1
284 .26679 .513 .692 1.66 .70 .22 285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .2 287 .26917 .513 .701 1.71 .70 .2 288 .26997 .504 .701 1.68 .71 .2 289 .27064 .504 .703 1.70 .70 .2 290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .718 1.73 .71 .2 295 .27453 .487 .721 1.75 .71 .2	1							-
285 .26827 .513 .695 1.68 .70 .22 286 .26843 .513 .698 1.70 .70 .2 287 .26917 .513 .701 1.71 .70 .2 288 .26997 .504 .701 1.68 .71 .2 289 .27064 .504 .703 1.70 .70 .2 290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 297 .2764 .487 .724 1.76 .71 .2							1	-
286 .26843 .513 .698 1.70 .70 .2 287 .26917 .513 .701 1.71 .70 .2 288 .26997 .504 .701 1.68 .71 .2 289 .27064 .504 .703 1.70 .70 .2 290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .2764 .487 .724 1.76 .71 .2							1	- 1
287 .26917 .513 .701 1.71 .70 .2 288 .26997 .504 .701 1.68 .71 .2 289 .27064 .504 .703 1.70 .70 .2 290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 295 .27625 .487 .721 1.75 .71 .2 297 .2764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2				1			1	- 1
288 .26997 .504 .701 1.68 .71 .22 289 .27064 .504 .703 1.70 .70 .22 290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .2764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.75 .72 .2 300 .27971 .479 .730 1.77 .71							1	- 1
289 .27064 .504 .703 1.70 .70 .2 290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.75 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2							I	- 1
290 .27187 .504 .706 1.72 .70 .2 291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2								- 1
291 .27259 .496 .706 1.69 .71 .2 292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2						l	1	
292 .27296 .496 .709 1.71 .71 .2 293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .735 1.81 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2			1 1					
293 .27339 .496 .715 1.74 .71 .2 294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .735 1.81 .71 .2 302 .28057 .479 .738 1.83 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2						l		- 1
294 .27365 .487 .715 1.71 .72 .2 295 .27453 .487 .718 1.73 .71 .2 296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2						1		
296 .27625 .487 .721 1.75 .71 .2 297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	294	.27365	.487	.715	1.71		72 .203	3
297 .27764 .487 .724 1.76 .71 .2 298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	295	.27453	.487	.718	1.73		71 .205	5
298 .27809 .479 .724 1.73 .72 .2 299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	296	.27625	.487	.721	1.75		71 .208	3
299 .27891 .479 .727 1.75 .72 .2 300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	297	.27764	.487	.724	1.76		71 .211	1
300 .27971 .479 .730 1.77 .71 .2 301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	298	.27809	.479	.724	1.73		72 .203	3
301 .27998 .479 .733 1.79 .71 .2 302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	299	.27891	.479	.727	1.75		72 .206	3
302 .28057 .479 .735 1.81 .71 .2 303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	300	.27971	.479	.730	1.77		71 .209	9
303 .28101 .479 .738 1.83 .71 .2 304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	301	.27998	.479	.733	1.79	■ .	71 .212	2
304 .28193 .479 .741 1.85 .70 .2 305 .28330 .479 .744 1.87 .70 .2	302	.28057	.479	.735	1.81	=	71 .214	4
305 .28330 .479 .744 1.87 .70 .2	303	.28101	.479	.738	1.83		71 .217	7
	304	.28193	.479	.741	1.85		70 .220	o
	305	.28330	.479	.744	1.87		70 .223	3
306 .28397 .479 .747 1.89 .70 .2	306	.28397	.479	.747	1.89		70 .226	6
307 .28445 .479 .750 1.92 .69 .2	307	.28445	.479	.750	1.92		69 .229	9
308 .28558 .471 .750 1.88 .71 .2	308	.28558	.471	.750	1.88		71 .22	1
309 .28648 .462 .750 1.85 .72 .2	309	.28648	.462	.750	1.85		72 .212	2
310 .28686 .462 .753 1.87 .71 .2	310	.28686	.462	.753	1.87		71 .21	5
311 .28725 .462 .756 1.89 .71 .2	311	.28725	.462	.756	1.89		71 .218	8
312 .28767 .462 .759 1.92 .71 .2	312	.28767	.462	.759	1.92		71 .22	1

313	.28829	.462	.762	1.94		.224
314	.28878	.454	.762	1.94	.71	.215
315	.28958	.454	.762	1.93	.72	
316	.29099					.218
1		.445	.765	1.89	.73	.210
317	.29188	.437	.767	1.88	.73	.204
318	.29229	.429	.767	1.84	.74	.196
319	.29306	.429	.770	1.87	.74	.199
320	.29356	.420	.770	1.83	.75	.191
321	.29415	.412	.770	1.79	.76	.182
322	.29518	.403	.770	1.76	.77	.174
323	.29574	.403	.773	1.78	.77	.177
324	.29623	.403	.776	1.80	.77	.180
325	.29701	.403	.779	1.83	.77	.182
326	.29751	.403	.782	1.85	.76	.185
327	.29805	.403	.785	1.88	.76	.188
328	.29850	.403	.788	1.90	.76	.191
329	.29888	.403	.791	1.93	.75	.194
330	.29951	.403	.794	1.95	.75	.197
331	.30002	.403	.797	1.98	.75	.200
332	.30073	.395	.797	1.94	.76	.191
333	.30217	.395	.799	1.97	.76	.194
334	.30329	.395	.802	2.00	.75	.197
335	.30382	.387	.802	1.96	.76	.189
336	.30763	.387	.805	1.98	.76	.192
337	.31155	.387	.808	2.01	.76	.195
338	.31208	.387	.811	2.05	.76	.198
339	.31244	.378	.811	2.00	.77	.189
340	.31281	.378	.814	2.03	.76	.192
341	.31332	.378	.817	2.06	.76	.195
342	.31469	.378	.820	2.10	.76	.198
343	.31630	.378	.823	2.13	.76	.201
344	.31735	.370	.823	2.09	.77	.192
345	.31829	.370	.826	2.12	.76	.195
346	.31962	.370	.828	2.16	.76	.198
347	.32065	.361	.828	2.11	.77	.190
348	.32100	.353	.828	2.06	.78	.181
349	.32196	.345	.828	2.01	.79	.173
350	.32306	.336	.828	1.96	.80	.165
351	.32382	.336	.831	1.99	.80	.168
352	.32485	.336	.834	2.03	.80	.170
	.52-700	.000	, .004	2.00	.00	.170

353	.32602	.336	.837	2.06	.79	.173
354	.32602	.336	.840	2.10	.79	.176
				2.10		.168
355	.32821	.328	.840		.80	
356	.32971	.319	.840	2.00	.81	.159
357	.33211	.319	.843	2.03	.81	.162
358	.33483	.319	.846	2.07	.80	.165
359	.33627	.319	.849	2.11	.80	.168
360	.33868	.319	.852	2.15	.80	.171
361	.34094	.311	.852	2.10	.81	.163
362	.34324	.303	.852	2.04	.82	.154
363	.34477	.303	.858	2.12	.81	.160
364	.34583	.303	.860	2.17	.81	.163
365	.34767	.294	.860	2.11	.82	.155
366	.34936	.294	.863	2.15	.82	.157
367	.35048	.294	.866	2.20	.81	.160
368	.35373	.286	.866	2.14	.82	.152
369	.35918	.286	.869	2.18	.82	.155
370	.36244	.277	.869	2.12	.83	.146
371	.36370	.277	.872	2.17	.83	.149
372	.36448	.277	.875	2.22	.83	.152
373	.36737	.277	.878	2.27	.82	.155
374	.37046	.277	.881	2.33	.82	.158
375	.37132	.269	.881	2.26	.83	.150
376	.37209	.269	.884	2.31	.83	.153
377	.37252	.269	.887	2.37	.82	.156
378	.37278	.269	.890	2.43	.82	.158
379	.37355	.269	.892	2.50	.82	.161
380	.37503	.261	.892	2.42	.83	.153
381	.37633	.261	.895	2.49	.83	.156
382	.37687	.261	.898	2.56	.82	.159
383	.37763	.252	.898	2.48	.83	.150
384	.38077	.244	.898	2.40	.84	.142
385	.38397	.244	.901	2.47	.84	.145
386	.38506	.244	.904	2.54	.84	.148
387	.38591	.244	.907	2.62	.83	.151
388	.38656	.244	.910	2.70	.83	.154
389	.38679	.244	.913	2.79	.83	.156
390	.38824	.235	.913	2.70	.84	.148
391	.39120	.227	.913	2.60	.85	.140
392	.39532	1		(4		
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393	.39795	.218	.916	2.59	.85	.134
394	.39821	.218	.919	2.68	.85	.137
.395	.39843	.218	.922	2.78	.85	.140
396	.39901	.218	.924	2.89	.85	.143
397	.40006	.218	.927	3.01	.84	.146
398	.40340	.210	.927	2.89	.85	.137
399	.40910	.202	.927	2.78	.86	.129
400	.41253	.193	.927	2.66	.87	.121
401	.41508	.185	.927	2.54	.88	.112
402	.42040	.185	.930	2.65	.88	.115
403	.42421	.176	.930	2.53	.89	.107
404	.42490	.176	.933	2.64	.88	.110
405	.42713	.176	.936	2.76	.88	.113
406	.43044	.176	.939	2.89	1.88	.115
407	.43226	.176	.942	3.04	.87	.118
408	.43709	.176	.945	3.20	.87	.121
409	.44159	.176	.948	3.37	.87	.124
410	.44210	.176	.951	3.57	.87	.127
411	.44450	.168	.951	3.40	.88	.119
412	.44723	.160	.951	3.23	.88	.110
413	.44809	.160	.953	3.43	.88	.113
414	.44862	.151	.953	3.25	.89	.105
415	.45002	.151	.956	3.47	.89	.108
416	.45111	".151	.959	3.72	.88	.111
417	.45189	.143	.959	3.51	.89	.102
418	.45331	.143	.962	3.78	.89	.105
419	.45609	.143	.965	4.10	.89	.108
420	.45833	.134	.965	3.85	.90	.100
421	.46149	.126	.965	3.61	.91	.091
422	.46481	.126	.968	3.94	.90	.094
423	.46786	.126	.971	4.34	.90	.097
424	.47230	.118	.971	4.05	.91	.089
425	.47685	.109	.971	3.76	.92	.080
426	.48026	.109	.974	4.18	.91	.083
427	.48128	.109	.977	4.70	.91	.086
428	.48627	.109	.980	5.37	.91	.089
429	.49360	.109	.983	6.26	.91	.092
430	.51343	.101	.983	5.78	.92	.083
431	.53702	.092	.983	5.30	.92	.075
432	.54970	.084	.983	4.82	.93	.067

E-11

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433	.55994	.076	.983	4.34	.94	.058
434	.57061	.076	.985	5.20	.94	.061
435	.57777	.067	.985	4.63	.95	.053
436	.57991	.067	.988	5.78	.94	.056
437	.58458	.059	.988	5.06	.95	.047
438	.59795	.059	.991	6.75	.95	.050
439	.60877	.050	.991	5.78	.96	.042
440	.63957	.050	.994	8.67	.96	.045
441	.67434	.050	.997	17.34	.95	.048
442	.67911	.042	.997	14.45	.96	.039
443	.69226	.042	1.000		•	.042
444	.71576	.034	1.000		•	.034
445	.72667	.025	1.000			.025
446	.80813	.017	1.000			.017
447	.93205	.008	1.000			.008
448	1.00000	.000	1.000			.000

Appendix F: Prognostic Indexes for Model Predicting Injuries Defined by the Training-Related Injury Index

Cut	Positive if	Sensitivity	Specificity	Positive	Negative	Youden's Index
Score	Probability of			Likelihood Ratio	Likelihood Ratio	-
#	Outcome					
	Greater Than or	(4)	*	-		
1	Equal To					
1	.00000	1.000	.000			.000
2	.00000	1.000	.003			.003
3	.00000	1.000	.006			.006
4	.01311	1.000	.008			.008
5	.03232	1.000	.011			.011
6	.03846	1.000	.014			.014
7	.03920	1.000	.017			.017
8	.04264	1.000	.019		•	.019
9	.04586	1.000	.022	.8	3 •	.022
10	.04771	1.000	.025		•	.025
11	.05014	1.000	.028			.028
12	.05364	1.000	.033		85	.033
13	.05777	1.000	.036			.036
14	.05957	1.000	.042			.042
15	.06040	.990	.042	1.03	.23	.032
16	.06886	.990	.045	1.04	.22	.035
17	.07802	.990	.047	1.04	.21	.038
18	.08112	.990	.050	1.04	.19	.040
19	.08299	.990	.061	1.05	.16	.052
20	.08439	.990	.064	1.06	.15	.054
21	.08570	.990	.067	1.06	.15	.057
22	.08725	.971	.103	1.08	.28	.074
23	.08992	.971	.114	1.10	.26	.085
24	.09140	.961	.114	1.09	.34	.075
25	.09280	.961	.125	1.10	.31	.087
26	.09421	.961	.128	1.10	.30	.089
27	.09448	.961	.131	1.11	.30	.092
28	.09528	.961	.134	1.11	.29	.095
29	.09616	.942	.164	1.13	.35	.106
30	.09706	.942	.167	1.13	.35	.109
31	.09854	.942	.170	1.13	.34	.112
32	.10099	.942	.173	1.14	.34	.114

33	.10329	.942	.175	1.14	.33	.117
34	.10385	.932	.245	1.23	.28	.177
35	.10470	.922	.245	1.22	.32	.167
36	.10658	.922	.248	1.23	.31	.170
37	.10766	.922	.251	1.23	.31	.173
38	.10835	.922	.253	1.24	.31	.176
39	.10918	.922	.256	1.24	.30	.179
40	.11007	.922	.265	1.25	.29	.187
41	.11094	.922	.273	1.27	.28	.195
42	.11124	.913	.276	1.26	.32	.188
43	.11258	.913	.287	1.28	.30	.200
44	.11396	.903	.287	1.27	.34	.190
45	.11443	.903	.290	1.27	.34	.193
46	.11566	.903	.292	1.28	.33	.195
47	.11685	.903	.295	1.28	.33	.198
48	.11760	.893	.295	1.27	.36	.188
49	.11842	.893	.298	1.27	.36	.191
50	.12029	.893	.301	1.28	.35	.194
51	.12206	.893	.309	1.29	.35	.202
52	.12274	.893	.315	1.30	.34	.208
53	.12419	.893	.318	1.31	.34	.211
54	.12550	.893	.320	1.31	.33	.214
55	.12596	.893	.329	1.33	.32	.222
56	.12629	.893	.345	1.36	.31	.239
57	.12776	.893	.348	1.37	.31	.241
58	.12969	.883	.393	1.45	· .30	.276
59	.13101	.883	.396	1.46	.29	.279
60	.13239	.883	.398	1.47	.29	.282
61	.13417	.883	.409	1.50	.28	.293
62	.13674	.883	.412	1.50	.28	.296
63	.13911	.883	.415	1.51	.28	.299
64	.14005	.883	.418	1.52	.28	.301
65	.14027	.883	.421	1.52	.28	.304
66	.14063	.883	.440	1.58	.26	.324
67	.14151	.874	.443	1.57	.28	.317
68	.14239	.864	.446	1.56	.30	.310
69	.14289	.864	.454	1.58	.30	.318
70	.14364	.864	.457	1.59	.30	.321
71	.14447	.864	.465	1.62	.29	.329
72	.14497	.854	.465	1.60	.31	.320
				E 0		

170	14004	054	400	ا به ب	l	
73 74	.14631 .14834	.854 .854	.468 .471	1.61	.31	.322
	i i			1.61	.31	.325
75	.14951	.854	.474	1.62	.31	.328
76	.15052	.854	.476	1.63	.31	.331
77	.15144	.835	.485	1.62	.34	.320
78	.15183	.825	.493	1.63	.35	.318
79	.15212	.825	.496	1.64	.35	.321
80	.15265	.825	.501	1.66	.35	.327
81	.15313	.825	.504	1.66	.35	.329
82	.15391	.816	.504	1.64	.37	.320
83	.15500	.806	.507	1.63	.38	.313
84	.15564	.806	.513	1.65	.38	.318
85	.15596	.806	.518	1.67	.37	.324
86	.15621	.806	.521	1.68	.37	.327
87	.15703	.806	.524	1.69	.37	.330
88	.15800	.806	.526	1.70	.37	.332
89	.15872	.806	.535	1.73	.36	.341
90	.15990	.806	.538	1.74	.36	.343
91	.16094	.806	.543	1.76	.36	.349
92	.16119	.806	.546	1.77	.36	.352
93	.16152	.806	.549	1.79	.35	.355
94	.16357	.796	.549	1.76	.37	.345
95	.16675	.786	.549	1.74	.39	.335
96	.16827	.786	.571	1.83	.37	.357
97	.16867	.786	.574	1.85	.37	.360
98	.16984	.786	.579	1.87	.37	.366
99	.17097	.786	.582	1.88	.37	.369
100	.17140	.777	.582	1.86	.38	.359
101	.17243	.777	.585	1.87	.38	.362
102	.17372	.767	.585	1.85	.40	.352
103	.17474	.767	.588	1.86	.40	.355
104	.17545	.767	.591	1.87	.39	.358
105	.17574	.767	.593	1.89	.39	.360
106	.17720	.767	.596	1.90	.39	.363
107	.17858	.767	.599	1.91	.39	.366
108	.17885	.767	.602	1.93	.39	.369
109	.17923	.767	.604	1.94	.39	.371
110	.18047	.757	.604	1.91	.40	.362
111	.18208	.757	.610	1.94	.40	.367
112	.18405	.757	.613	1.96	.40	.370

113	.18649	.748	.618	1.96	.41	.366
114	.18800	.748	.621	1.97	.41	.369
115	.18847	.748	.624	1.99	.40	.372
116	.18893	.709	.635	1.94	.46	.344
117	.18984	.709	.646	2.00	.45	.355
118	.19063	.709	.649	2.02	.45	.358
119	.19174	.709	.652	2.04	.45	.361
120	.19409	.709	.657	2.07	.44	.366
121	.19597	.699	.657	2.04	.46	.356
122	.19674	.699	.660	2.06	.46	.359
123	.19736	.689	.660	2.03	.47	.349
124	.19783	.689	.663	2.05	.47	.352
125	.19945	.689	.666	2.06	.47	.355
126	.20101	.689	.669	2.08	.46	.358
127	.20130	.689	.671	2.10	.46	.361
128	.20347	.680	.671	2.07	.48	.351
129	.20727	.670	.677	2.07	.49	.347
130	.21052	.650	.680	2.03	.51	.330
131	.21235	.650	.685	2.07	.51	.336
132	.21447	.650	.688	2.09	.51	.339
133	.21738	.650	.694	2.12	.50	.344
134	.22135	.650	.696	2.14	.50	.347
135	.22462	.650	.702	2.18	.50	.352
136	.22573	.641	.705	2.17	.51	.346
137	.22772	.631	.708	2.16	.52	.339
138	.23091	.612	.713	2.13	.54	.325
139	.23337	.602	.713	2.10	.56	.315
140	.23472	.602	.716	2.12	.56	.318
141	.23636	.602	.719	2.14	.55	.321
142	.23743	.583	.735	2.20	.57	.318
143	.23796	.573	.735	2.16	.58	.308
144	.23824	.563	.747	2.22	.59	.310
145	.24102	.563	.749	2.25	.58	.312
146	.24516	.553	.758	2.28	.59	.311
147	.24682	.534	.760	2.23	.61	.294
148	.24801	.534	.763	2.26	.61	.297
149	.25006	.524	.769	2.27	.62	.293
150	.25283	.524	.772	2.30	.62	.296
151	.25531	.524	.774	2.32	.61	.299
152	.25959	.524	.777	2.35	.61	.301

153	.26403	.524	.783	2.41	.61	.307
154	.26526	.524	.788	2.48	.60	.313
155	.26912	.485	.799	2.42	.64	.285
156	.27539	.476	.802	2.41	.65	.278
157	.27831	.476	.805	2.44	.65	.281
158	.27874	.456	.808	2.37	.67	.264
159	.27957	.447	.808	2.32	.69	.254
160	.28080	.437	.808	2.27	.70	.245
161	.28240	437	.811	2.31	.69	.247
162	.28587	.437	.813	2.34	.69	.250
163	.28911	.437	.822	2.45	.69	.259
164	.29157	.437	.825	2.49	.68	.261
165	.29366	.437	.827	2.53	.68	.264
166	.29438	.437	.830	2.57	.68	.267
167	.29674	.437	.833	2.61	.68	.270
168	.30113	.437	.836	2.66	.67	.273
169	.30840	.427	.838	2.64	.68	.266
170	.31471	.427	.844	2.74	68	.271
171	.31933	.427	.852	2.89	.67	.280
172	.32280	.427	.855	2.95	.67	.282
173	.32356	.427	.858	3.01	.67	.285
174	.32511	.417	.858	2.94	.68	.275
175	.33018	.408	.858	2.87	.69	.266
176	.33453	.398	.858	2.80	.70	.256
177	.33620	.388	.858	2.73	.71	.246
178	.33989	.388	.864	2.85	<i>.</i> 71	.252
179	.34388	.379	.864	2.77	.72	.242
180	.34598	.379	.866	2.83	.72	.245
181	.35362	.379	.869	2.89	.71	.248
182	.36536	.359	.869	2.74	.74	.228
183	.37140	.359	.877	2.93	.73	.237
184	.37837	.359	.880	3.00	.73	.239
185	.38531	.350	.883	2.99	.74	.233
186	.38750	.340	.891	3.13	.74	.231
187	.38927	.330	.891	3.04	.75	.221
188	.39137	.330	.894	3.12	.75	.224
189	.39284	.330	.897	3.20	.75	.227
190	.39453	.330	.900	3.29	.74	.230
191	.39729	.330	.903	3.39	.74	.233
192	.39902	.320	.903	3.29	.75	.223

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193	.40410	.311	.911	3.49	.76	.222
194	.40916	.311	.914	3.60	.75	.224
195	.41179	.311	.916	3.72	.75	.227
196	.41646	.301	.916	3.60	.76	.217
197	.41944	.301	.919	3.73	.76	.220
198	.42319	.282	.930	4.04	.77	.212
199	.43023	.272	.930	3.90	.78	.202
200	.43524	.272	.933	4.07	.78	.205
201	.43777	.262	.933	3.92	.79	.195
202	.44624	.252	.933	3.78	.80	.186
203	.45702	.252	.936	3.94	.80	.188
204	.46185	.252	.939	4.12	.80	.191
205	.46607	.243	.939	3.96	.81	, .181
206	.47182	.233	.939	3.80	.82	.172
207	.47476	.214	.947	4.04	.83	.161
208	.47803	.214	.950	4.26	.83	.163
209	.48658	.184	.955	4.14	.85	.140
210	.49278	.165	.964	4.56	.87	.129
211	.49492	.165	.967	4.94	.86	.132
212	.50094	.165	.969	5.39	.86	.134
213	.50739	.146	.975	5.81	.88	.121
214	.51083	.136	.975	5.42	.89	.111
215	.51645	.126	.975	5.03	.90	.101
216	.52615	.117	.975	4.65	.91	.091
217	.53395	.107	.975	4.26	.92	.082
218	.54059	.107	.978	4.79	.91	.085
219	.54564	.097	.978	4.36	.92	.075
220	.54666	.087	.978	3.92	.93	.065
221	.55266	.087	.981	4.48	.93	.068
222	.55860	.078	.981	3.98	.94	.058
223	.56747	.068	.981	3.49	.95	.048
224	.58083	.058	.981	2.99	.96	.039
225	.58648	.049	.981	2.49	.97	.029
226	.59049	.049	.989	4.36	.96	.037
227	.60706	.049	.992	5.81	.96	.040
228	.63519	.049	.994	8.71	.96	.043
229	.65161	.039	.994	6.97	.97	.033
230	.65683	.039	.997	13.94	.96	.036
231	.68923	.039	1.000			.039
232	.72043	.029	1.000		<u> </u>	.029

233	.73190	.019	1.000		.019
234	.78688	.010	1.000		.010
235	1.00000	.000	1.000		.000

Appendix G: Prognostic Indexes for Model Predicting Failure of Final Army Physical Fitness Test

1621						
Cut	Positive if	Sensitivity	Specificity	Positive	Negative	Youden's Index
Score	Probability of			Likelihood Ratio	Likelihood Ratio	
#	Outcome				s	
	Greater Than or					
	Equal To				` <u></u>	
1	.00000	1.000	.000			.000
2	.00002	1.000	.002			.002
3	.00003	1.000	.004			.004
4	.00004	1.000	.006			.006
5	.00007	1.000	.013			.013
6	.00012	1.000	.015	ĕ .	₹	.015
7	.00017	1.000	.017			.017
8	.00021	1.000	.019			.019
9	.00025	1.000	.021			.021
10	.00029	1.000	.024	· ·		.024
11	.00036	1.000	.026			.026
12	.00044	1.000	.030			.030
13	.00055	1.000	.032			.032
14	.00067	1.000	.036			.036
15	.00074	1.000	.038			.038
16	.00086	1.000	.041			.041
17	.00100	1.000	.047			.047
18	.00124	1.000	.053			.053
19	.00150	1.000	.071			.071
20	.00167	1.000	.073			.073
21	.00187	1.000	.075		· .	.075
22	.00205	1.000	.077			.077
23	.00238	1.000	.090			.090
24	.00291	1.000	.094			.094
25	.00357	1.000	.107			.107
26	.00437	1.000	.111			.111
27	.00511	1.000	.135			.135
28	.00568	1.000	.141			.141
29	.00656	1.000	.143			.143
30	.00766	1.000	.165			.165
31	.00852	1.000	.169			.169
32	.00984	1.000	.171			.171

33	.01149	1.000	.203	, a		.203
34	.01277	1.000	.209			.209
35	.01421	1.000	.214			.214
36	.01561	1.000	.216	–		.216
37	.01718	1.000	.248			.248
38	.01909	1.000	.259	■ .		.259
39	.02123	.978	.263	1.33	.08	.241
40	.02330	.978	.265	1.33	.08	.243
41	.02563	.956	.318	1.40	.14	.274
42	.02844	.956	.327	1.42	.14	.282
43	.03275	.956	.338	1.44	.13	.293
44	.03807	.956	.425	1.66	.10	.381
45	.04219	.956	.429	1.67	.10	.385
46	.04681	.956	.447	1.73	.10	.402
47*	.05124	.956	.449	1.73	.10	.404
48	.05620	.800	.673	2.45	.30	.473
49**	.06216	.800	.697	2.64	.29	.497
50	.06880	.778	.712	2.70	.31	.489
51	.07515	.756	.712	2.62	.34	.467
52	.08222	.733	.718	2.60	37	.451
53	.09067	.733	.748	2.91	.36	.481
54	.10003	.667	.793	3.22	.42	.459
55	.11546	.667	.795	3.25	.42	.462
56	.13045	.622	.808	3.24	.47	.430
57	.14325	.578	.853	3.92	.50	.430
58	.16410	.578	.863	4.23	.49	.441
59	.18414	.467	.885	4.04	.60	.351
60	.20098	.467	.891	4.28	.60	.358
61***	.22792	.444	.900	4.43	.62	.344
62	.26588	267	.966	7.80	.76	.232
63	.30741	.222	.968	6.93	.80	.190
64	.35250	.200	.970	6.69	.82	.170
65	.42688	.111	.983	6.50	.90	.094
66	1.00000	.000	1.000	n " .		.000

^{*} Illustration of cut score selected for high sensitivity, characterized in Table 14.

^{**} Cut score with maximum Youden index value in ROC curve, illustrated in Figure 2.

^{***} Illustration of cut score selected for high specificity, characterized in Table 15.

Appendix H: Prognostic Indexes for Model Predicting Attrition

Cut	Positive if	Sensitivity	Specificity	Positive	Negative	Youden's Index
Score	Probability of			Likelihood Ratio	Likelihood Ratio	
#	Outcome		1			
_ =	Greater Than or		:			
	Equal To					1 "
1	.00000	1.000	.000			.000
2	.00129	1.000	.002			.002
3	.00134	1.000	.004			.004
4	.00140	1.000	.006			.006
5	.00153	1.000	.008			.008
6	.00168	1.000	.010			.010
7	:00179	1.000	.012			.012
8	.00190	1.000	.014			.014
9	.00203	1.000	.016			.016
10	.00212	1.000	.018			.018
11	.00219	1.000	.020			.020
12	.00228	1.000	.021			.021
13	.00235	1.000	.023			.023
14	.00236	1.000	.025			.025
15	.00242	1.000	.027			.027
16	.00249	1.000	.029			.029
17	.00251	1.000	.035			.035
18	.00259	1.000	.037			.037
19	.00267	1.000	.039	П,		.039
20	.00276	1.000	.041			.041
21	.00294	1.000	.045			.045
22	.00309	1.000	.047			.047
23	.00317	1.000	.049			.049
24	.00321	1.000	.051			.051
25	.00327	1.000	.061			.061
26	.00338	1.000	.063			.063
27	.00353	1.000	.064			.064
28	.00364	1.000	.066			.066
29	.00370	1.000	.070			.070
30	.00381	1.000	.072		= = =.	.072
31	.00387	1.000	.078			.078
32	.00391	1.000	.084			.084

33	.00403	1.000	.090			.090
34	.00412	1.000	.094			.094
35	.00415	1.000	.098			.098
36	.00423	1.000	.100			.100
37	.00434	1.000	.102			.102
38	.00466	1.000	.104			.104
39	.00496	1.000	.107			.107
40	.00506	1.000	.115			.115
41	.00521	1.000	.117			.117
42	.00527	1.000	.119			.119
43	.00532	1.000	.125		2*	.125
44	.00548	1.000	.127			.127
45	.00561	1.000	.131		(a.	.131
46	.00579	1.000	.143		S.	.143
47	.00596	1.000	.145			.145
48	.00609	1.000	.152		,	.152
49	.00625	1.000	.154			.154
50	.00633	1.000	.156	*	×	.156
51	.00637	1.000	.160	*		.160
52	.00640	1.000	.162	¥	64	.162
53	.00659	1.000	.164		- 4	.164
54	.00697	1.000	.168	8		.168
55	.00739	1.000	.184			.184
56	.00762	1.000	.186	*		.186
57	.00787	1.000	.199			.199
58	.00811	1.000	.203		94	.203
59	.00837	1.000	.219			.219
60	.00863	1.000	.223			.223
61	.00890	1.000	.238		*	.238
62	.00916	1.000	.240		9	.240
63	.00917	1.000	.242			.242
64	.00948	1.000	.254		8 <u>4</u>	.254
65	.00990	1.000	.273			.273
66	.01017	1.000	.275			.275
67	.01033	1.000	.277	·		.277
68	.01037	1.000	.281		4	.281
69	.01046	1.000	.307			.307
70	.01077	1.000	.309			.309
71	.01103	1.000	.311			.311
72	.01127	1.000	.328			.328

73	.01160	1.000	.330	.1		.330
74	.01172	1.000	.334			.334
75	.01185	1.000	.344		12 II	.344
76	.01209	1.000	.346			.346
77	.01233	1.000	.348			.348
78	.01246	1.000	.350		т.	.350
79	.01273	1.000	.367			.367
80	.01308	1.000	.371			.371
81	.01318	1.000	.373	= .	-5-11 ·	.373
82	.01320	1.000	.375			.375
83	.01325	.947	.377	1.52	.14	.324
84	.01349	.947	.385	1.54	.14	.332
85	.01375	.947	.387	1.54	.14	.334
86	.01393	.947	.389	1.55	.14	.336
87	.01408	.947	.391	1.55	.13	.338
88	.01429	.947	.406	1.60	.13	.354
89	.01471	.947	.408	1.60	.13	.356
90	.01497	.947	.414	1.62	.13	.361
91	.01508	.947	.430	1.66	.12	.377
92	.01538	.947	.432	1.67	.12	.379
93	.01574	.947	.434	1.67	.12	.381
94	.01591	.947	.436	1.68	.12	.383
95	.01629	.947	.449	1.72	.12	.397
96	.01679	.947	.451	1.73	.12	.399
97	.01737	.947	.469	1.78	.11	.416
98	.01788	.947	.471	1.79	.11	.418
99	.01797	.947	.473	1.80	.11	.420
100	.01810	.947	.490	1.86	.11	.438
101	.01823	.947	.492	1.87	.11	.440
102	.01849	.947	.494	1.87	.11	.442
103	.01893	.947	.496	1.88	.11	.443
104	.01969	.947	.510	1.93	.10	.457
105	.02029	.947	.514	1.95	.10	461
106	.02070	.947	.543	2.07	.10	.490
107	.02133	.947	.545	2.08	.10	.492
108	.02219	.947	.555	2.13	.09	.502
109	.02286	.947	.559	2.15	.09	.506
110	.02353	.895	.574	2.10	.18	.469
111	.02425	.842	.574	1.98	.27	.416
112	.02455	.842	.609	2.16	.26	.451

113	.02494	.842	.611	2.17	.26	.453
114	.02553	.842	.613	2.18	.26	.455
115	.02670	.842	.629	2.27	.25	.471
116	.02775	.842	.648	2.40	.24	.491
117	.02830	.789	.648	2.25	.32	.438
118	.02890	.789	.650	2.26	.32	.440
119	.02947	.789	.656	2.30	.32	.446
120	.02984	.789	.658	2.31	.32	.448
121	.03005	.789	.660	2.32	.32	.450
122	.03026	.789	.662	2.34	.32	.452
123	.03037	.789	.666	2.36	.32	.455
124	.03069	.789	.668	2.38	.32	.457
125	.03107	.737	.674	2.26	.39	.437
126	.03175	.737	.676	2.27	.39	.413
127	.03253	.737	.678	2.29	.39	.415
128	.03282	.737	.682	2.23	.39	.418
129	.03389	.737	.688	2.36	.38	.416
130	.03491	.737	.691	2.39	.38	.428
131	.03565	.737	.693	2.40	.38	.430
132	.03673	.737	.695	2.42	.38	.432
133	.03731	.632	.713	2.20	.52	.344
134	.03778	.632	.715	2.21	.52	.346
135	.03825	.632	.717	2.23	.51	.348
136	.03852	.632	.719	2.25	.51	.350
137	.03885	.632	.721	2.26	.51	.352
138	.03926	.632	.723	2.28	.51	.354
139	.04045	.579	.732	2.16	.57	.311
140	.04166	.579	.734	2.18	.57	.313
141	.04210	.579	.744	2.26	.57	.323
142	.04284	.579	.746	2.28	.56	.325
143	.04360	.579	.748	2.30	.56	.327
144	.04413	.579	.750	2.32	.56	.329
145	.04515	.579	.754	2.35	.56	.333
146	.04602	.579	.756	2.37	.56	.335
147	.04658	.579	.758	2.39	.56	.337
148	.04731	.526	.760	2.19	.62	.286
149	.04763	.526	.762	2.21	.62	.288
150	.04864	.526	.764	2.23	.62	.290
151	.04975	.526	.768	2.26	.62	.294
152	.05053	.526	.785	2.45	.60	.311

154 .05240 .526 .789 2.50 .60 .315 155 .05368 .474 .789 2.25 .67 .263 156 .05452 .474 .791 2.27 .67 .265 157 .05499 .474 .793 2.29 .66 .267 158 .05546 .474 .793 2.231 .66 .299 159 .05565 .474 .801 2.38 .66 .274 160 .05594 .474 .803 2.40 .66 .276 161 .05633 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .284 163 .05771 .474 .818 2.53 .65 .288 164 .05770 .474 .818 2.61 .64 .290 165 .05791 .474 .818 2.61 .64		1	I	1	× 1	- 1	- 1
155 .05368 .474 .789 2.25 .67 .263 156 .05452 .474 .791 2.27 .67 .265 157 .05499 .474 .793 2.29 .66 .267 158 .05566 .474 .795 2.31 .66 .269 159 .05565 .474 .801 2.38 .66 .274 160 .05594 .474 .803 2.40 .66 .276 161 .05633 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .282 163 .05721 .474 .813 2.53 .65 .288 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .818 2.61 .64 .290 166 .05820 .474 .820 2.64 .64	153	.05150	.526	.787	2.47	.60	.313
156 .05452 .474 .791 2.27 .67 .265 157 .05499 .474 .793 2.29 .66 .267 158 .05566 .474 .795 2.31 .66 .269 159 .05565 .474 .801 2.38 .66 .274 160 .05594 .474 .803 2.40 .66 .276 161 .05633 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .288 164 .05770 .474 .816 2.55 .65 .288 165 .05791 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .292 167 .05890 .474 .826 2.73 .64	154	.05240	.526	.789	2.50	.60	.315
157 .05499 .474 .793 2.29 .66 .267 158 .05546 .474 .795 2.31 .66 .269 159 .05565 .474 .801 2.38 .66 .274 160 .05594 .474 .803 2.40 .66 .276 161 .05633 .474 .809 2.47 .65 .284 162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .816 2.58 .64 .290 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .816 2.58 .64 .290 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64	155	.05368	.474	.789	2.25	.67	.263
158 .05546 .474 .795 2.31 .66 .269 159 .05565 .474 .801 2.38 .66 .274 160 .05594 .474 .803 2.40 .66 .276 161 .05693 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .826 2.73 .64 .302 168 .05981 .474 .826 2.73 .64 .302 170 .06212 .474 .830 2.79 .63	156	.05452	.474	.791	2.27	.67	.265
159 .05565 .474 .801 2.38 .66 .274 160 .05594 .474 .803 2.40 .66 .276 161 .05633 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .826 2.73 .64 .300 169 .06096 .474 .826 2.73 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .830 2.96 .63	157	.05499	.474	.793	2.29	.66	.267
160 .05594 .474 .803 2.40 .66 .276 161 .05633 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .826 2.73 .64 .294 168 .05981 .474 .826 2.73 .64 .300 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63	158	.05546	.474	.795	2.31	.66	.269
161 .05633 .474 .809 2.47 .65 .282 162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 170 .06212 .474 .832 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .857 2.95 .68	159	.05565	.474	.801	2.38	.66	.274
162 .05663 .474 .811 2.50 .65 .284 163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .857 2.95 .68	160	.05594	.474	.803	2.40	.66	.276
163 .05721 .474 .813 2.53 .65 .286 164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .304 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68	161	.05633	.474	.809	2.47	.65	.282
164 .05770 .474 .814 2.55 .65 .288 165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67	162	.05663	.474	.811	2.50	.65	.284
165 .05791 .474 .816 2.58 .64 .290 166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73	163	.05721	.474	.813	2.53	.65	.286
166 .05820 .474 .818 2.61 .64 .292 167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73	164	.05770	.474	.814	2.55	.65	.288
167 .05890 .474 .820 2.64 .64 .294 168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 179 .07473 .368 .873 2.90 .72	165	.05791	.474	.816	2.58	.64	.290
168 .05981 .474 .826 2.73 .64 .300 169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72	166	.05820	.474	.818	2.61	.64	.292
169 .06096 .474 .828 2.76 .64 .302 170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77	167	.05890	.474	.820	2.64	.64	.294
170 .06212 .474 .830 2.79 .63 .304 171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .203 181 .07847 .316 .889 2.84 .77	168	.05981	.474	.826	2.73	.64	.300
171 .06275 .474 .832 2.82 .63 .306 172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76	169	.06096	.474	.828	2.76	.64	.302
172 .06494 .474 .840 2.96 .63 .314 173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .203 182 .07925 .316 .887 2.79 .77 .203 183 .07979 .316 .896 3.05 .76 .212 184 .0808 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 <td>170</td> <td>.06212</td> <td>.474</td> <td>.830</td> <td>2.79</td> <td>.63</td> <td>.304</td>	170	.06212	.474	.830	2.79	.63	.304
173 .06728 .421 .855 2.91 .68 .277 174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 <td>171</td> <td>.06275</td> <td>.474</td> <td>.832</td> <td>2.82</td> <td>.63</td> <td>.306</td>	171	.06275	.474	.832	2.82	.63	.306
174 .06797 .421 .857 2.95 .68 .278 175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .0808 .316 .898 3.11 .76 .214 185 .08183 .316 .902 3.23 .76	172	.06494	.474	.840	2.96	.63	.314
175 .06950 .421 .859 2.99 .67 .280 176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .0808 .316 .898 3.11 .76 .216 185 .08183 .316 .902 3.23 .76 .216 187 .08432 .263 .918 3.21 .80	173	.06728	.421	.855	2.91	.68	.277
176 .07114 .368 .867 2.77 .73 .236 177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80	174	.06797	.421	.857	2.95	.68	.278
177 .07151 .368 .869 2.82 .73 .238 178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .953 3.37 .88 <td>175</td> <td>.06950</td> <td>.421</td> <td>.859</td> <td>2.99</td> <td>.67</td> <td>.280</td>	175	.06950	.421	.859	2.99	.67	.280
178 .07300 .368 .871 2.86 .73 .240 179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.51 .88 <td>176</td> <td>.07114</td> <td>.368</td> <td>.867</td> <td>2.77</td> <td>.73</td> <td>.236</td>	176	.07114	.368	.867	2.77	.73	.236
179 .07473 .368 .873 2.90 .72 .241 180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.51 .88 .111 191 .09270 .158 .955 3.51 .88 <td>177</td> <td>.07151</td> <td>.368</td> <td>.869</td> <td>2.82</td> <td>.73</td> <td>.238</td>	177	.07151	.368	.869	2.82	.73	.238
180 .07640 .316 .885 2.74 .77 .201 181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	178	.07300	.368	.871	2.86	.73	.240
181 .07847 .316 .887 2.79 .77 .203 182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	179	.07473	.368	.873	2.90	.72	.241
182 .07925 .316 .889 2.84 .77 .204 183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	180	.07640	.316	.885	2.74	.77	.201
183 .07979 .316 .896 3.05 .76 .212 184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	181	.07847	.316	.887	2.79	.77	.203
184 .08088 .316 .898 3.11 .76 .214 185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	182	.07925	.316	.889	2.84	.77	.204
185 .08183 .316 .900 3.17 .76 .216 186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	183	.07979	.316	.896	3.05	.76	.212
186 .08307 .316 .902 3.23 .76 .218 187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	184	.08088	.316	.898	3.11	.76	.214
187 .08432 .263 .918 3.21 .80 .181 188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	185	.08183	.316	.900	3.17	.76	.216
188 .08677 .211 .918 2.57 .86 .128 189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	186	.08307	.316	.902	3.23	.76	.218
189 .08998 .158 .951 3.23 .89 .109 190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	187	.08432	.263	.918	3.21	.80	.181
190 .09164 .158 .953 3.37 .88 .111 191 .09270 .158 .955 3.51 .88 .113	188	.08677	.211	.918	2.57	.86	.128
191 .09270 .158 .955 3.51 .88 .113	189	.08998	.158	.951	3.23	.89	.109
	190	.09164	.158	.953	3.37	.88	.111
	191	.09270	.158	.955	3.51	.88	.113
192 .09568 .158 .957 3.67 .88 .115	192	.09568	.158	.957	3.67	.88	.115

1	1	1		1	1	
193	.09836	.158	.959	3.85	.88	.117
194	.09869	.158	.961	4.04	.88	.119
195	.10236	.158	.963	4.25	.87	.121
196	.10639	.158	.965	4.49	.87	.123
197	.11179	.158	.967	4.76	.87	.125
198	.11956	.158	.969	5.05	.87	.127
199	.12302	.158	.971	5.39	.87	.129
200	.12460	.158	.973	5.77	.87	.131
201	.12639	.158	.975	6.22	.86	.133
202	.13094	.158	.977	6.74	.86	.134
203	.13814	.158	.979	7.35	.86	.136
204	.14206	.158	.980	8.08	.86	.138
205	.14849	.158	.982	8.98	.86	.140
206	.15737	.158	.984	10.11	.86	.142
207	.17525	.158	.986	11.55	.85	.144
208	.19365	.158	.988	13.47	.85	.146
209	.20505	.158	.990	16.17	.85	.148
210	.21522	.158	.992	20.21	.85	.150
211	.22997	.158	.994	26.95	.85	.152
212	.27434	.158	.996	40.42	.85	.154
213	.31122	.105	.996	26.95	.90	.101
214	.35324	.105	.998	53.89	.90	.103
215	.41268	.053	.998	26.95	.95	.051
216	.46458	.053	1.000			.053
217	1.00000	.000	1.000			.000